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A METHOD OF ESTIMATING RAINFALL BY THE GROWTH OF TREES*

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In the great northern plateau of Arizona, lying at an average altitude of 6,000 feet above the sea, the higher elevations are covered with forests of yellow pine (*Pinus ponderosa*), a fine timber tree with heavy cylindrical trunk and bushy top. The trees are scattered gracefully over the plains and hills, and, with the remarkable absence of undergrowth, render travel through their midst attractive and delightful. For centuries these magnificent pines have stood there, enduring the vicissitudes of heat and cold, flood and drought. The possibility that they might serve as indices of the climate of the past led the author to begin the investigation of the matter in 1901. His line of reasoning was as follows: (1) The rings of a tree measure its food supply; (2) food supply depends largely upon the amount of moisture, especially in this dry climate where the quantity is limited and the life struggle of the tree is against drought rather than against competing vegetation; (3) in such countries, therefore, the rings are likely to form a measure of the precipitation. In planning the work three fundamental steps were anticipated. First, to prepare a curve of tree growth; second, to find if there exists in this any connection with precipitation; third, by carrying this back through long periods to find whether meteorological variations, if discovered, show association with astro-

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nomical phenomena. A fourth step has been added by Dr. Ellsworth Huntington, namely, the application of such tree records to the investigation of historical conditions and events.

Advantages of Location. The pine tree of northern Arizona lends itself peculiarly well to the investigation here contemplated. Not only is its situation favorable climatically, and because of the absence of other vegetation and of pests which might seriously alter the growth of the tree, but the soil is of such a nature that variations in precipitation are quickly felt in the tree. The tree itself is favorable, because of its conspicuous annual rings. The difference between the soft, rapidly growing white tissues of the summer, and the slow-growing reddish layer formed in the fall, is much less conspicuous in most of the common trees than in the pine. The sharp, outer edge where the growth of the red layer is checked by the cold of winter, gives a precise point from which to measure.

Meteorological records in northern Arizona are necessarily meager, yet not so deficient as might be expected. The record at Whipple Barracks, near Prescott, which was begun in 1867, is the longest continuous record in the pine forest, and is therefore made use of below.

The Collection and Measurement of Sections. At the beginning of the investigation it was foreseen that enough trees would have to be measured to give a real average. The trees would have to be spread over enough country, and be sufficiently numerous to eliminate accidents of grouping and other minutely local conditions, and yet they must not extend beyond a single meteorological region. They must be numerous enough to be susceptible of division into groups, which, by showing common characteristics, would testify to the genuineness of whatever variations appeared. Accordingly in the first series of measurements twenty-five trees from near Flagstaff were made use of. They were divided into three groups: A, six trees from three miles south of Flagstaff; B, nine trees from about eleven miles southwest of Flagstaff; C, ten trees a mile west of the last. The method of measurement consisted of determining the thickness of each annual ring in millimeters along some typical radial line. The average age of the trees was 348 years, with two extending to 520 years, more than a hundred years before the discovery of America. The total number of individual measurements reached over ten thousand. A comparison of the three groups clearly reveals the general character of the variations hereafter to be discussed.

Other interesting facts also came to light. It was especially noticeable that years of marked peculiarities could be identified in different trees with surprising ease. Perhaps the most characteristic feature was a group of narrow rings about the years 1879-1884. These could be identified in practically every tree, and an examination of stumps scattered about the country showed that it was easy to pick them out wherever one chose. In the case of one stump near town, which had been cut some twenty years previously, this group of rings enabled the writer to name the year in which the tree was felled, and the date was verified exactly by the owner of the land. In the more recent work this same group shows conspicuously among Prescott trees, and in general 95 per cent. of these trees have rings so characteristically marked that the identification of the same series can be made with little doubt whether at Flagstaff or at Prescott.

As a rule, the thickness of a given ring is not uniform on all sides of the tree. It varies slightly for accidental reasons, and also according to the points of the compass. The maximum growth occurs a little to the east of north. The average variation between the maximum growth in the northerly direction and minimum growth to the south is 12 per cent. The relative width of rings in different radii of a tree is wonderfully constant in these Arizona pines. This is not so of all trees.

The Dating of Rings. In comparing the growth of trees and the rainfall over long periods of years, it is essential that the date of formation of any individual ring shall be certain. As a rule, each annual ring is extremely well marked, and there is no doubt as to its purely annual or seasonal character. In some cases, however, rings die out completely, while in others they are double. Such defects tend to cause errors in dating the earlier rings. In the first investigation of the trees at Flagstaff, it was thought that the final result was subject to an error of 2 per cent., most of which occurred near the center of the tree from doubling. The more rigorous methods subsequently employed, however, proved that the error of unchecked counting in those trees was 4 per cent., and lay almost entirely in the recent years. It was due chiefly to the omission of rings. Such errors can only be guarded against by a process of cross identification which will be described shortly. The common effect of errors of omission or doubling of rings is to lessen the intensity of the variations in the curve of growth. After cross identification, however, I find the remaining errors may be divided

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into two classes, first, local errors of identity in small groups of rings in a few individual trees, which simply flatten the curve in one small part, without affecting other portions at all; and, second, cases in which a given ring, in spite of all attempts at cross identification, is still in doubt. This error does not flatten the curve at all but does lend the same doubt to the date of all earlier rings.

The Trees of Prescott. The problem of cross identification is well illustrated in the trees of Prescott. These were measured in 1911 for the purpose of testing the conclusions derived from the Flagstaff trees some years earlier. About 3,500 measures were made upon 64 cuttings selected in five groups depending on their nearness to town. The farthest group was 10 miles southeast and the nearest one mile south. It was apparent that the agreement between growth and precipitation increased as the location of the actual rainfall station was approached. The nearest group, containing ten trees, shows so much greater agreement than do the others that it has been used alone in drawing final conclusions.

The chief feature of the Prescott series which places its results on a firmer basis than any previous work is the cross identification of rings between trees. The extent and accuracy of this identification came as a surprise to me. After measuring the first eighteen sections it became apparent that much the same succession of rings occurred in each, and, thereupon, the other sections were examined and the general appearance of some sixty or seventy rings memorized. All the sections were then reviewed and identification marks placed in the wood against certain rings. Some conspicuous characteristics were noted, such as that the red ring of 1896 is nearly always double; the rings of 1884 and 1885 are wider than their neighbors. The most pronounced feature was a series of compressed rings from 1878 to 1883 (as noted at Flagstaff), preceded by a very faint 1877 and then a wider series. Out of 67 sections averaging fifty rings each, only two proved puzzling, and they are mentioned here because they were the worst cases of defective ring systems observed in this entire investigation. After minute examination it finally appeared fairly certain that one of them had the rings from 1879 to 1887 merged into one, and the rings from 1890 to 1895 merged into one. The other had the rings from 1890 to 1895 in one and 1898 to 1900 in one. Previous to those dates the rings were entirely normal, showing perfect agreement with the other trees.

The cross identification of trees from the Prescott region was

limited to a district only ten miles long. It was a surprise then to find that rings in the Flagstaff sections could be identified at once in terms of the rings at Prescott. The process appears to be applicable to areas still farther removed from one another. Two trees out of three which were tested from the Santa Rita Mountains in southeastern Arizona, 200 miles from Prescott, were found to have rings which could readily be identified in terms of the Prescott series.

Yearly Identification. Upon the complete comparison between the Prescott trees only one ring contained a doubt, namely, the sixth counting in from the bark: did this ring represent 1904 alone or was it really a double representing both 1903 and 1904? The decisive evidence strangely enough came from Flagstaff. The cross identification between the sections from Prescott and Flagstaff made it possible to identify most of the rings both before and after 1903, and Flagstaff plainly showed two rings in place of the doubtful ring or rings at Prescott. Hence this was apportioned to the two years 1903 and 1904. Apparently if a sufficient number of comparisons be made and if the trees thus compared be distributed over widely different localities, the yearly identification of rings may be made with almost perfect certainty (see footnote 1).

Month of Beginning Annual Means. Before passing on to other matters, a word of explanation must be added as to the method of calculating the rainfall.

That it must take some time for the transmutation of rain into an important part of the organic tissue is evident. Moreover, snow cannot be absorbed until it has melted. At Flagstaff the precipitation of November is almost always in the form of snow, and therefore that month should certainly be considered as falling after the arboreal new year. Hence for purposes of comparison with tree growth, the month of beginning annual means would fall some time in the autumn. This matter has been tested empirically. Annual means have been formed beginning at various months from July 1st of the previous year to March 1st of the current year. These were compared with the tree growth, and it was found that the years beginning November 1st at Flagstaff and September 1st at Prescott give the closest agreement. These dates therefore are used.

The Time of Year of Ring Formation. Among the problems connected with the relation of the growth of trees and the amount of rainfall, one of the most interesting was suggested by Mr. R. H.

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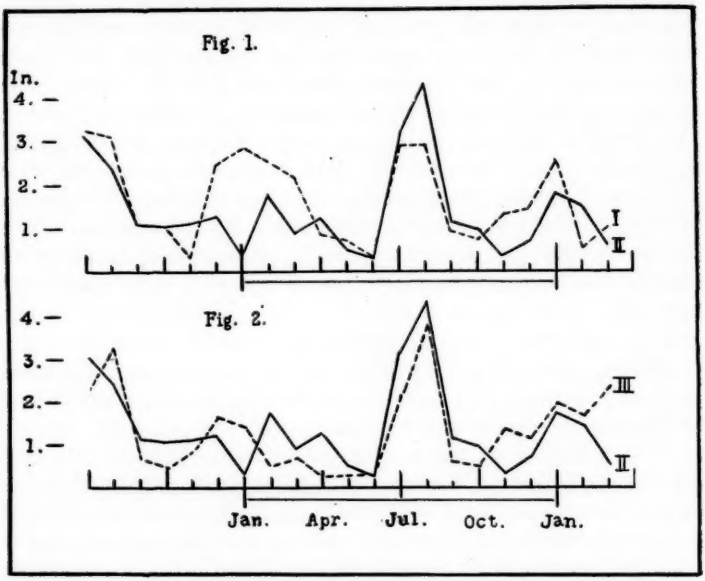
Forbes of the Arizona Experiment Station. The problem is to determine the time of formation of the red or autumn portion of the rings, and the causes of the doubling. This study is the more necessary because many rings in the Prescott series, although very few at Flagstaff, show a faint, preliminary red ring, forming a double. The first test was designed to determine the distribution and character of the rainfall in the years producing such double rings. The half-dozen most persistent years of doubling were



FIGS. 1 and 2—Rainfall and Doubling of Rings.

I. Monthly rainfall in years producing large single rings.
II. Monthly rainfall in years producing large double rings.
III. Monthly rainfall in years producing small single rings.

selected and their mean rainfall plotted month by month. This forms the solid line in Figure 1. Six other years averaging the same growth, 1.55 mm., but producing single red rings, were then selected and the monthly rainfall plotted as before. This forms the dotted line in the same figure. The curves seem to indicate clearly that the chief cause of doubling is a deficiency of snowfall in the winter months, December to March. This means that if the winter precipitation is sufficient to bridge over the usual spring drought, the growth continues through the year, giving a large

single ring which ends only in the usual red layer as the severity of winter comes on. If, however, the preceding winter precipitation has not been entirely adequate, the spring drought taxes the resources of the tree, and some red tissue of deficient absorption comes on in summer.

It appears further that if the few spring drought rains are unusually scanty, then the tree may "close up shop" for the year and produce its final red tissue in midsummer, gaining no immediate benefit from the summer rains, even though they are abundant. This appears to be the interpretation of Figure 2. Here the same six double-forming years used above are plotted, together with a list of six years selected for small single rings particularly deficient in red tissues. In these it is evident that extreme drought in the spring stops the growth of the tree. The double ring then seems to be an intermediate form between the large, normal, single ring, growing through the year, and the small, deficient, ring ending its growth by mid-summer. So also the red tissue appears to be formed in times of decreasing absorption, whether following excessive spring drought or the waning activities of autumn.

Rainfall and Tree Growth at Prescott and Their Relation

All the preceding investigations lead up to the actual comparison between tree growth and rainfall and the question of the accuracy with which one represents the other. A complete answer will necessarily require a large amount of work and pass beyond the scope of this article but even now some definite idea may be obtained. Figure 3 displays a forty-three year comparison obtained at Prescott, Arizona. On the whole there is close agreement, as may be seen by matching the crests and troughs of one with those of the other. These curves, then, support the idea of a proportional relation between annual rainfall and annual growth.

In order to obtain a still more accurate idea of this relationship, an effort has been made to construct formulas for reducing one to the other. Without entering into details, it is sufficient to say that the result gave an agreement of over 80 per cent. This is shown in Figure 5, whose slight errors might fairly be expected considering the mile or more of distance separating the trees from the rainfall station. Figure 4 shows the main basis of transition from Figure 3 to Figure 5, namely that the mean growth of the tree is proportional to the accumulated rain. Regarding any formula, however,

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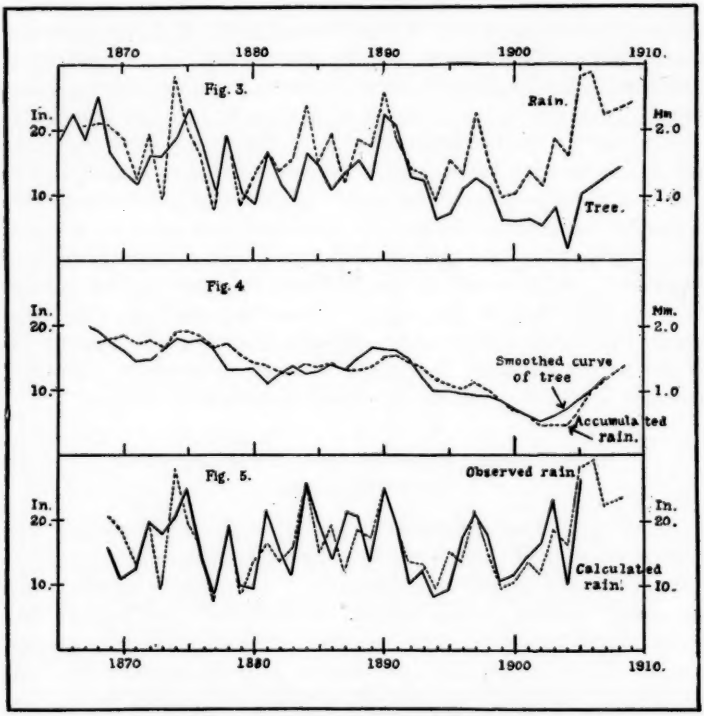
it should be emphasized that one found to apply in dry climate conditions, such as exist in Arizona, is likely to be very different from one operating in moist climates and perpetually water-soaked ground.



FIGS. 3 to 5—Rainfall and Tree Growth at Prescott, Arizona, 1865–1908.

Fig. 3. Tree growth and rainfall, uncorrected.
Fig. 4. Accumulated rainfall and smoothed curve of tree growth.
Fig. 5. Observed rainfall and computed rainfall.

THE FLAGSTAFF 500-YEAR CURVES

In the preceding portions of this article, we have endeavored to determine the exact relation between growth and rainfall, and to ascertain the most accurate method of obtaining results. We shall now apply these conclusions and methods to the oldest available trees. For this purpose 19 of the Flagstaff sections were selected, and were subjected to minute examination and cross identification,

in order, as far as possible, to eliminate all errors due to the omission or doubling of rings. For convenience in handling the sections, each one was reduced to a strip of wood extending from center to bark. The best of these was adopted as a standard. It was then compared with each of the others, ring for ring. In the entire period only one ring was held as doubtful, that of 1822, which was often merged with that for 1821. The two rings appear as one in ten sections, and as two in only nine, but in many or most of the cases where it appeared as two, they were so distinctly separate that they were finally so regarded. This is not absolutely certain, however, and thus there may be an error of one year in the portions of the growth before 1822. So far as known, there is no probability of any other error.[1]

Test of Accuracy of Record in Small Groups. In studies like the present, it is manifestly desirable to carry the curves of growth as far back as possible. Inasmuch as only a few trees go back to an age of over 300 or 400 years, the curves for earlier centuries may be less accurate than those for later. In order to test the degree of accuracy to be obtained from a small number of trees, a comparison was made between large groups and small. After the entire number of rings, some 6,300 in all, had been identified and numbered, their measures were tabulated in overlapping groups, and in a convenient manner averages were obtained of the oldest five reaching back 400 years; the oldest ten (including the preceding five) reaching back 350 years; the oldest fifteen (including the ten) reaching 300 years, and the entire nineteen reaching only 200 years. Finally at the ancient end of the first group, the oldest two were carried back to fully 500 years. On plotting these various groups, it was immediately evident that five trees gave almost the same record as ten or fifteen, even to small details. So in the work discussed below, the five are used to give the record from about 1503 to 1906. In a similar manner, the comparison between these five and the oldest two taken by themselves gave an agreement not quite so perfect, yet so close that errors thus introduced will not at all affect the curves referred to below. However, the oldest two were

[1] Some months after writing the above, I reviewed H. H. Bancroft's "History of Arizona and New Mexico" with special reference to climatic records. Some fourteen cases of agreement with the Arizona tree record as thus identified were found, to one doubtful case of disagreement, and the identification here used was considered as confirmed, having no likelihood of error in any part. Regarding this particular case Bancroft says, on page 302: "Irrigation generally protected the inhabitants against drought, as in 1803 and in 1820-2"; and on page 309, note 8, he states that in 1823 the Indians claimed to be dying of hunger. The trees show poor growth in 1820 and 1823 and *very* poor in 1822, thus forming a group of poor years corresponding well with his description of drought and famine from 1820 to 1823.

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very slow-growing trees and they required on the average an increase of about 30 per cent. in order to make their curve continuous with the whole five. Thus the tree record is made to begin at 1392. In the recent years of the record also, between 1891 and

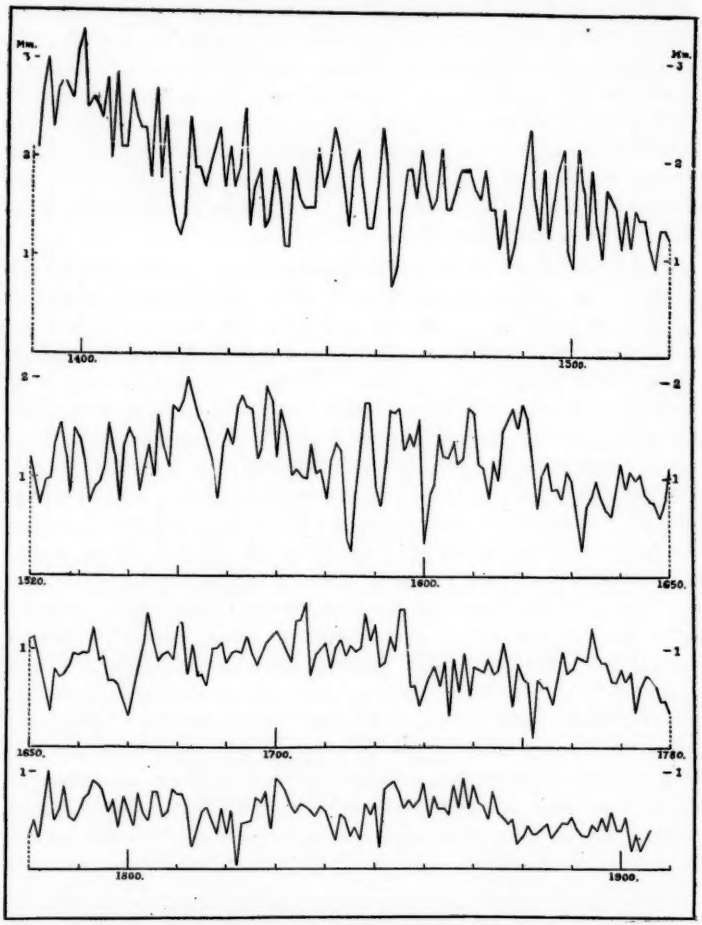


FIG. 6—Tree Record in Northern Arizona, 1392-1906.

1896, a slight correction was made for omitted rings, the complete omission of a ring being an exaggeration that introduces error. Thus Figure 6 gives the tree record for northern Arizona from 1392 to 1906, inclusive, a period of 515 years.

Climatic Cycles. Investigations of rainfall are undertaken for the purpose of predicting the future. The basis of daily or short distance prediction is found in the conditions existing about the country at a given moment and a knowledge of the usual movement of storm areas. A basis for long distance prediction is now generally sought in climatic cycles. Such cycles may or may not be permanent. Perhaps they are nothing more enduring than a series of wave systems on a water surface. Yet for the navigator a knowledge of the existing system is important, and so for the purpose of weather prediction we need to know the nature of the pulsations actually operating, and each one should be studied minutely. For this purpose the very long tree record and its presumable fair accuracy seem especially advantageous, since it gives us a range in centuries which the meteorological records with few exceptions give only in decades. In order to adapt it properly for this purpose it has been corrected empirically for age by drawing a long, sloping, nearly straight line through it from end to end, averaging its growth and then calculating the percentage of departure of each year from this line.

The 33-Year and Longer Variations. In order to bring out the longer variations the curve was smoothed by 20-year overlapping means. The result gives four conspicuous crests about the years 1400, more or less, 1560, 1710 and 1865, suggesting a very long period. A period of 33.8 years fits very well since 1730, with a total amplitude of some 25 per cent., and very poorly before that, yet without entire discordance. The last crest came in 1900. This we readily identify as the well-known Brückner period.[2]

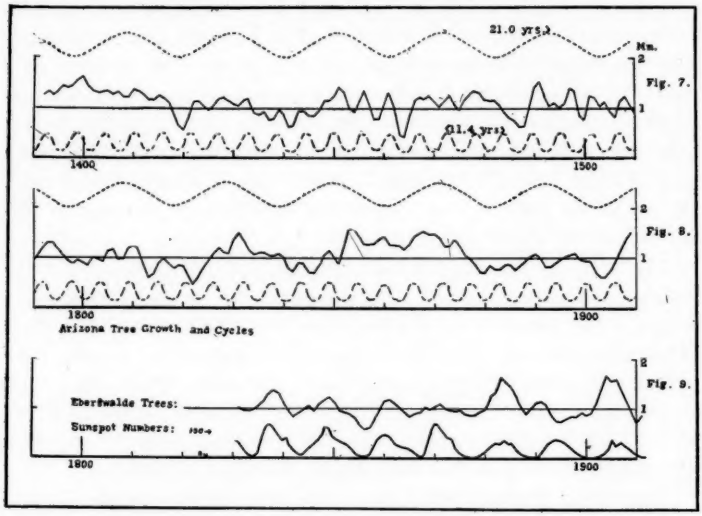
A 21-Year Period. The most persistent of the longer periods seems to be approximately 21 years in length with an average amplitude of 20 per cent. (10 per cent. from the mean), and its last crest in 1892. This pulsation is well marked from 1410 to 1520; then in the next hundred years it has three or four glaring discrepancies; finally from 1610 to the present time it is again strongly marked and very regular. Dr. W. J. S. Lockyer, in his "Discussion of Australian Meteorology"[3] finds a pronounced 19-year cycle in barometric pressures in Australia and South America. The 21-year period was worked out independently in 1907 and 1908, from an early and crude tree record of 200 years. It seems quite possible that these two periods are the same. If so, and if my inter-

[2] "Klimaschwankungen seit 1700"; see also H. W. Clough, *Astrophysical Journ.*, Vol. 22, 1905, July, p. 42, and many others.

[3] South Kensington Solar Physics Observatory, 1909.

pretation of the tree curves is correct, the real value is likely to be closer to 21 years since the time interval here investigated is about ten times as long as his. Something of this 21-year variation is shown in the dotted lines of Figures 7 and 8. The application becomes more evident when the minor variations are smoothed.

The 11-Year Cycle. The last cycle to be considered is that of eleven years. In the sixty years during which the eleven-year sunspot and magnetic cycles have been accepted, this period has been of the greatest interest, for, if found to be terrestrial, it must signify a connection between the sun and the earth other than



FIGS. 7 and 8—Arizona Tree Growth and Cycles, 1390–1510 and 1790–1910 (21-year period, dotted; tree growth, solid; 11.4-year double cycles, broken line).
FIG. 9—Eberswalde (Germany) Trees and Sunspot Numbers, 1830–1910.

gravity which holds the earth in place, and the mere constant heat energy which sustains all life. Since 1873 numerous writers (Koeppen, Bigelow, Lockyer, Abbott, Buchan, Hann, Hellmann, Arctowski and others) have found variations in the ordinary meteorological elements, rainfall, temperature, pressure, etc., corresponding to this period. But so much disagreement appeared at the same time between different workers, and the periods of time used were so short, that much doubt has remained. Hence it is of peculiar interest to see whether the trees which carry the rainfall record back so far with a comparatively high degree of accuracy,

show the same cycle. In nearly all parts of the long, 500-year curve, there are plain suggestions of an eleven-year variation. By tracing these throughout the record, the most satisfactory period is found to have a length of very nearly 11.4 years, which is practically the sunspot cycle. (The sunspot cycle is sufficiently variable to render almost any period between 11.0 and 11.8 equally applicable, since 1755. This will be discussed and illustrated in another place.) The average double amplitude of the tree period is 16 per cent. The average form of this cycle during different portions of the last five centuries has been ascertained, from which it appears that it is not uniform throughout (see Figure 10). In general the curve shows two maxima and two minima: from 1400 to 1670, the second is the deeper and its recurrence most regular, as shown in Figure 7; from then to 1790 the curve flattens out and has less marked cyclic character, or the period of the cycle is varying; from that time to the present, there are again two minima, but the first is more conspicuous.

Something of this may be seen in Figures 7, 8 and 10. In Figures 7 and 8 the first and last centuries of the tree record are respectively shown, smoothed in each case by Hann's formula. Hann's formula is usually given $T'_n = \frac{1}{4}(T_{n-1} + 2T_n + T_{n+1})$ but is better described and obtained as the *second* set of intermediate values, that is, the second set of means of successive, overlapping, pairs. With each are plotted the corresponding sections of a double-crested 11.4-year cycle cast to the best advantage upon the whole five hundred years. By comparing the crests of this cycle with the respective crests in the tree curve, one can see to what degree the tree varies on that particular cycle. Throughout Figure 7 the growth varies closely on the double-crested 11-year period and less perfectly on the 21-year. In Figure 8 the case seems to be partially reversed.

Correlation between tree growth and sunspot variation is not confined to the American region here investigated. A series of measures on thirteen tree sections (*Pinus sylvestris*) from the forest of Eberswalde, near Berlin, Germany, the first of a number of series to be made on North European pine trees, discloses a striking time relation of similar character. Figure 9 exhibits the results on this group. The mean curve for the whole thirteen was corrected for age and smoothed by three-year means. This smoothed curve is given in the figure and below it is the sunspot curve. The similarity may be traced without further comment.

The 11-Year Tree Cycle Compared with Solar and Some Meteorological Elements. A final comparison of the 11-year cycle with

the mean sunspot curve and with two meteorological elements, temperature and rainfall, on the adjacent California coast, gives a significant series of curves. Figure 10 has on its upper line the average of all the 11.4-year periods in the whole five hundred years.

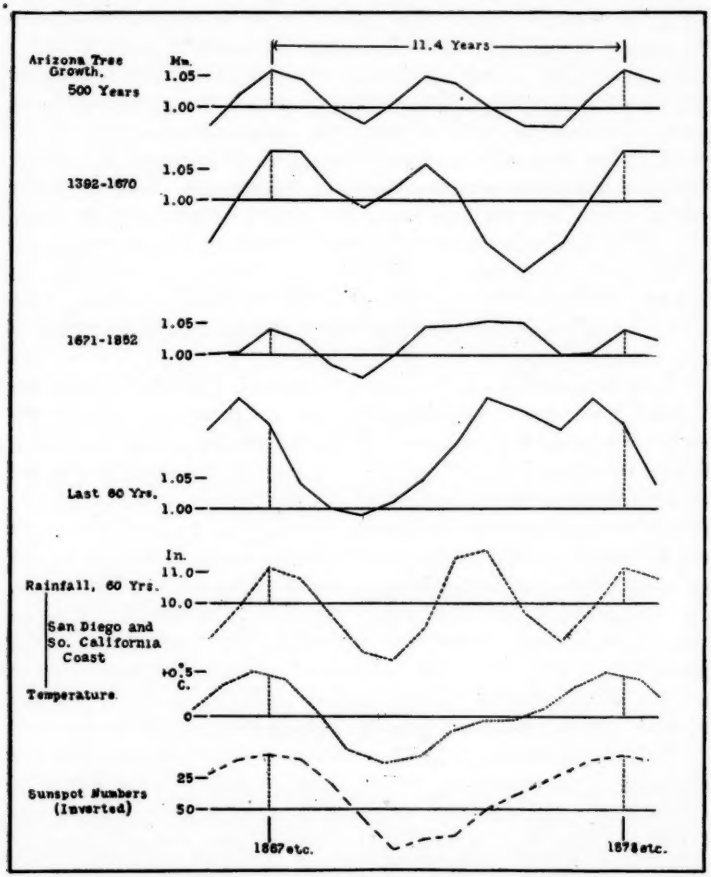


FIG. 10—Study of an 11.4-year Period. First four curves: Arizona tree growth: (1) average for the 500 years covered by the period of investigation; (2 to 4) curves for the periods 1392–1670, 1671–1852 and 1850–1911, respectively. Last three curves: rainfall and temperature on the coast of southern California and inverted sunspot numbers for the period 1850–1911.

Below this is a partial analysis of the same in different intervals in three curves which show variations in this cycle. The last of the three is taken for sixty years only, in order to give an exact com-

parison with the curves which follow. The first dotted curve is the coast rainfall for sixty years arranged on identical periods. Although this coast is five hundred miles distant from the Arizona trees, and lies beyond the mountains, yet the crests and troughs of the tree growth in Arizona match those of the rainfall in California. This is not surprising, for while the summer rains of northern Arizona have no relation to those on the coast, the winter precipitation in the two regions varies in harmony. Below the rainfall curve is placed another, showing the average temperature at San Diego during the 11-year periods since 1850. Shorter curves of temperature and rainfall of other coast towns show the same characteristics as those of San Diego. The lowest curve shows the sunspot numbers (inverted) for the same interval from 1850 to the present time.

There appears to be a marked similarity between these curves. Even the subordinate crest which sometimes shows in the change from maximum to minimum sunspots, matches the suppressed second crest of temperature and the full second crests of rainfall and tree growth. This would seem impossible in the absence of a real relationship between them.

Conclusion. Further research will probably show other, and perhaps still more important, relationship between the growth of vegetation, meteorological elements and changes in the sun. Meanwhile, the methods of computing rainfall from tree growth must be still further perfected. Already, however, the original purpose of the work here outlined has been accomplished. A connection has been found between tree growth and rainfall, a curve of tree growth has been made for at least one locality, apparent climatic cycles have been observed and indications of association between meteorological and astronomical phenomena have been found. But the most important part of all, I hope, has been the origin and development of a method of estimating rainfall, capable of extension to other regions, and of adaptation to other branches of science.

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EFFECTS OF CONTINENTAL GLACIATION ON AGRICULTURE*

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3. Glacial Soils

(*a*) *Characteristics Distinguishing Glacial Soils from other Soils and their Agricultural Significance.* Glacial soils may be regarded as composed of a thorough mixture of mechanically derived material from many rock types, especially when they comprise a portion of the drift sheet resulting from continental glaciation. Such soils have been subject to solvent denudation only since their deposition by the glaciers, geologically a very short time. Residual, alluvial and other soils outside the glaciated areas, are, in contrast with the glacial soils, mostly accumulated as the result of chemical weathering and represent the relatively insoluble material of the rocks from which they are derived, or the stable secondary compounds formed during the processes of chemical weathering. Mechanical weathering has some part in the accumulation of a mantle of rock waste in non-glacial regions, but its influence is largely confined to the detachment and splitting up of larger rock fragments, which, by such processes, are made the more susceptible to complete disintegration and recombination later by chemical means. Thus non-glacial soils in humid, agricultural regions owe their characteristics primarily to the effects and results of chemical reactions on the bed rock from which they are derived. Under such conditions the relatively soluble materials of the bed rock are carried away while the resistant original minerals and the stable secondary compounds compose the soil particles.

To this contrast in origin—the glacial soils made up of mechanically derived detritus, a mixture of all the materials from many rock types, while the non-glacial soils are chemically derived insoluble residues—is commonly ascribed the greater average fertility, productiveness and value of the glacial soils. The conception is that the mechanically derived mixtures forming the glacial soils contain the mineral plant foods both in greater actual amount and in a more available form than do the weathering soils. Such data

* Concluded from the April *Bulletin*, pp. 241-264.

as are available[27] indicate that this is actually the case and probably accounts in part for the greater agricultural worth of the glacial soils. While a detailed discussion of this phase of the subject cannot be entered into here, it should be stated that it is maintained by some soil investigators that the capillary rise of water from subsoil and underlying bed rock, brings up more than enough of the soluble mineral plant food materials to compensate for the downward movement and leaching of such materials by the action of gravitational waters sinking through the larger soil pores during the relatively short periods of rainfall. If their contention is correct, textural variations in soils are more important than differences in the amounts of mineral plant foods present, as shown by chemical analyses, which latter do not necessarily indicate their availability for plants.

However, if the greater agricultural value of the glaciated lands were dependent on differences in soil composition alone, it would not be determined by merely chemical considerations. As has been shown above many other factors enter in to give the advantage agriculturally to the glaciated provinces. But, eliminating these for the moment, there are reasons, other than actual chemical make-up, inherently characteristic of the glacial soils themselves which may be cited to account for their greater productivity.

Local conditions of weathering and character of the bed rock are largely determinant of the nature of sedentary soils, both of their textural and chemical make-up. In consequence of this, where the country is alternately underlain by good and poor soil makers, the worth of the soils of the region will vary with them, and the phenomenon of fertile and relatively infertile soil in strips and bands is noted. This may be extreme, or only observable on careful examination. That this relation exists and may cause radical soil changes within short distances was clearly shown for an area in southeast England by Hall and Russell[28] of the Rothamstead Experiment Station. These authors also found that the Al_2O_3 of the clay in fertile soils had double the percentage solubility in the fertile as contrasted with the infertile soils, thus indicating that the differences were not wholly of a textural character. In glacial soils such rapid variations due to bed rock character do not occur. While a large percentage of the recognizable material in the de-

[27] von Engeln, O. D.: Some Factors Influencing the Percentages of Mineral Plant Foods Contained in Soils, *Amer. Journ. of Science*, Vol. XXXII, Nov., 1911, p. 350.

[28] Hall, A. D. and Russell, E. J.: Soil Surveys and Soil Analyses, *Journ. of Agric. Science*, Vol. IV, Pt. 2, Oct., 1911.

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posits from continental glaciers have been shown to be of local material,[29] this is not to be considered as local in any such restricted sense as in the case of the weathering soils, but local in that it represents largely a commingling of recognizable material from near adjacent areas. The finer material, the rock flour of glacial grinding, probably represents a much greater mixture of material, of which much is from distant sources. Plant growth, further, is much more influenced by the character and percentage of the fine material than by the coarser recognizable particles. In this matter of being a mixture, the glacial soils, therefore, resemble very closely alluvial bottom land or flood plain soils of the non-glacial regions, and these are proverbially fertile. Where, however, the glaciers passed over wide areas of rock, whose soil forming qualities are poor, the glacial soils also reflect in some degree the sterility which would mark soils derived from them by weathering processes.

The content of organic matter as determined by glacial action is another factor which must be recognized as contributing much to the reputed fertility of glacial soils. Thus almost all of the great prairie region of the Central West of the United States is covered by what has been termed the Marshall series of glacial soils.[30] They are characterized and distinguished from the Miami series of glacial soils by the relatively large quantity of organic matter in the surface soils, which gives them a dark brown or black color. These accumulations of organic matter may be ascribed to the very level character of the topography of these areas, due to the conditions of glacial deposit which resulted in poor natural drainage, and, consequently, of incomplete decomposition of the plant residues of their original vegetation cover. With artificial drainage, where necessary, these soils have become the great corn soils of the country and are very productive.

It is interesting to note also that, of the soil types of this series determined by texture, as well as of the other two great series of glacial soils, the Miami and Volusia, the loam, silt loam and clay loam types are noted as being the most valuable for general farm purposes, and that these are also the types which have by far the greatest acreage over the area so far surveyed.[31] Thus it is seen that the glacial soils possess distributional and compositional ad-

[29] Alden, W. C.: The Delavan Lobe of the Lake Michigan Glacier of the Wisconsin Stage of Glaciation and Associated Phenomena, *U. S. Geol. Surv. Prof. Paper 34*, 1904, pp. 86–87.

[30] Whitney, Milton: Soils of the United States, *Bur. of Soils Bull. 55*, p. 144, U. S. Dept. of Agric., 1909.

[31] Whitney, M.: *op. cit.*, pp. 144–147.

vantages, favorable to agriculture, other than that of simply greater initial content of mineral plant food.

(*b*) *Variation in Age of Glacial Soils with respect to Crop Productivity.* From what has been said above, it may be gathered that the geological youth of the glacial soils is a factor of importance in determining their superior agricultural worth. The original, undecomposed nature of the glacial soil particles, rock flour, and the short time they have been exposed to weathering processes are in part responsible for their so-called lasting and strong qualities in contrast with weaker, non-glacial soils. This distinction may be extended farther to include differences between the glacial soils themselves, according to the relative ages of the glaciations during which they were deposited. Thus Hopkins[32] has shown that, in the several glaciations which have, in the main, given rise to the soils found in Illinois, there is a progressive increase in the mineral plant food content of such soils from the oldest to the youngest. Moreover, a very real difference exists in the actual productivity of the soils of the early and late glaciations, whether or not this depends on the mineral plant foods present in them. Hubbard[33] shows this very strikingly by contrasting the agricultural conditions in the north-and-south adjacent Coles and Cumberland Counties of Illinois, the former lying almost wholly within the Early Wisconsin glaciation, while the latter has a Lower Illinoisan glaciation soil-cover over the greater part of its area. Land values in Coles County at the time the article was written ranged between \$75-\$125 per acre, with the average above \$75; while in Cumberland County (with the older Illinoisan glaciation soil-cover) the prices were between \$15-\$40 with the average near \$30. According to the 1910 census[34] average farm values in Coles County were \$125 per acre and over, while in Cumberland County they ranged between \$50 and \$75 per acre, yet in both counties 90-95% of the land was found to be in farms. According to Hubbard again, the value of crops, per acre of improved land, was from \$10-\$15 for Coles County and from \$6-\$10 for Cumberland County.

It may be that these differences in productivity should be ascribed to conditions of physiographic, rather than geologic youth and age, for in Coles County tile drainage is practiced, rich swamp

[32] Hopkins, C. G., and Pettit, J. H.: The Fertility in Illinois Soils, *Univ. of Ill., Agric. Expt. Sta. Bull. 123*, pp. 201-202.

[33] Hubbard, Geo. D.: A Case of Geographic Influence upon Human Affairs, *Bull Amer. Geogr. Soc.*, Vol. XXXVI, 1904, pp. 145-157.

[34] *Bulletin Thirteenth Census of the United States, 1910: Agriculture, Illinois*, map p. 2.

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lands are thus reclaimed, while in Cumberland County such drainage is useless, primarily because tributaries to main natural drainage streams are developed in so much greater numbers as to make the map of Cumberland County appear darker. Thus relative dissection of the glacial deposits themselves apparently makes for differences in crop productivity irrespective of differences in mineral plant food content. Leverett[35] makes clear the very strong contrasts in this respect which appear between the deposits of the different glaciations. "In the Illinoisan glacial drifts of western Illinois approximately one-half the surface has been reduced below the original level as a result of post-Illinoisan glaciation drainage development; while in the Wisconsin drift, post-Wisconsin drainage has scarcely sufficed to reduce one-tenth its original surface." In connection with such weathering and dissection the older glacial soils may have also undergone structural and textual modifications detrimental to fertility. As the youngest glaciations did not extend so far south and east in Central Europe as did the earlier ones it is possible that these glacial lands would show, if an exact comparison could be made, because of their greater age, an average lesser productiveness than do the younger glacial deposits which cover so large a part of the area of the central United States and southern Canada.

(*c*) *Textural Variations of Glacial Soils in relation to Diversified Agriculture.* In its broadest sense the term, intensive agriculture, implies the utilization both of the land and the labor of the man on the land to their utmost extent and according to the best methods and with the best equipment possible. Fulfillment of these conditions involves continual occupation for the labor on the farm. In order that this may be possible a variety of tasks to suit the different conditions of weather and season must be available; accordingly a variety of crops must be grown so that the work does not all come at once. In other words, diversified, as well as intensive agriculture, must be practiced to get the greatest possible economic advantage from the land. Even in regions where intensive agriculture, in the more restricted sense of specialization in one crop, is unprofitable, the opportunity for a diversified agriculture is important, for it means the possibility of producing a large proportion of the variety of foods demanded by the human and animal labor on the farm itself, where field crops are extensively raised for

[35] Leverett, F.: Weathering and Erosion as Time Measures, *Amer. Jour. of Science*, Vol. XXVII, 1909, pp. 356-7.

a money return. Therefore, if the soil over a large area is restricted, texturally and in other characteristics, to a very narrow variation in type, adapted to only a comparatively few crops, such uniformity in soil type is necessarily a detriment to both intensive and diversified farming. This is an economic disadvantage, as, with increasing density of population in civilized countries, a more and more intensive and diversified agriculture must be practiced.

According to present knowledge different plants are more adapted to textural variations than to variations in the other known characteristics of the soil. On the other hand this adaptation of plants to certain soils is often so marked that it has been proposed to classify soils according to their natural typical plant growth. Crops also are adapted to certain soils. A compilation made from a wide range of agricultural literature[36] showed that among others the following crops could be grown in largest quantity and in some cases also of best quality on the textural soil type indicated:

Clay—wheat, timothy, blue grass.
Silt loam—corn, apple.
Loam—red clover, alfalfa, field beans.
Sandy soils—potato, field peas, turnip, barley, rye, buckwheat, peach.
Calcareous soil—white clover.
Muck soils—celery, cabbage, lettuce, onions.

This list includes only such crops as show marked adaptation. It could be much extended if others were included that, other conditions being equally favorable, thrive best on certain soil types.

The application of the above paragraphs is found in the wide variety of conditions which attended the deposition of material by the ice during the retreat of the continental glaciers, giving rise to a great diversity in soil types. A list of the different forms of glacial deposit to which distinctive names have been given will almost suffice to show how wide the range in texture is. Often, moreover, these forms intergrade in a manner most puzzling to the glacial physiographer who attempts to map them, such combinations adding further complexity to the soil texture in the glaciated regions.

Conspicuously developed terminal, recessional and lateral moraines are commonly stony, with a filling of gritty clay between the boulders. Though large boulders may not predominate the materials composing their ridges are typically coarse, sandy and

[36] By Dr. Bouyoucos, formerly of the N. Y. State Agric. College at Cornell University, soil seminar, March 20, 1911.

gravelly, in general unfit for cultivation. In the central plains and prairie region of the United States such morainic masses are commonly given over to farm wood-lots and pasture land. Similarly the coarse stratified material of kames and eskers and their steep topography unfits them for the plow and they are generally timber-covered so that it is difficult to obtain good photographs showing the sinuosities of an esker course. Drumlin forms are equally steep but have better soils texturally; they are, therefore, generally under cultivation. Much more extensive in area over the glaciated regions than the conspicuous ridge deposits of moraine, kame, esker and drumlin, are the lower, more massive moraines, the ground moraine and the till sheet. These forms can not be sharply differentiated in the field. They grade into one another. In general they comprise the material deposited by the ice during periods of slow but essentially continuous melting back. Under such conditions the thin wedge at the front of the ice may be conceived of as fairly clogged with debris, super-, en- and subglacially, a concentration of all the stuff distributed through a much greater thickness of ice back from the front. Away from hilly and mountainous regions this material was probably mainly massed in the lower ice layers, the cargo acquired by erosion and abrasion in the long journey from the centers of ice dispersion. In regions of greater relief, where ridges and summits projected far up into the body of the ice currents, or even through them, in the waning stages, englacial and superglacial material amounted to a much greater bulk of the deposits laid down. Thus the till sheet (embracing in that general term the low massive moraines and the ground moraine) varies in composition from the thin bouldery deposits of the New England uplands (where it has been estimated that in some parts it took on the average a month's work for a man to remove the large stones from each acre to get it ready for plowing) to the deep, fine textured aggradations of the plains areas, derived from prevailing soft rocks, converted into rock flour by glacial grinding under the sole of the ice, and extending now practically level and unbroken over miles of area. Although such extremes in texture occur in these deposits of similar origin the till sheet on the whole supplies a prevailingly fine soil. Of the approximately 24,000,000 acres of area covered by such glacial material that have been mapped in the United States by soil surveys, about 73 per cent. has been found to come within the narrow textural range of loam, silt loam and clay loam. These are all heavy soils adapted to general farming, and they have been desig-

nated the great wheat and corn soils of the country.[37] The smaller areas of coarser, lighter soils, sandy in texture, associated with the loam soils, and part of the same deposits in origin, are well adapted to fruit and vegetable growing, though not yet utilized to their fullest extent. Thus while plenty of opportunity is afforded for variety of crops, the greater proportion of such lands is specially adapted to the growing of the two grains which are staple foods for man and beast.

The surface portions of the till sheet deposits no doubt owe their prevailingly fine texture in part to postglacial weathering, but, in part also, to the influence of outwash waters depositing fine particles between the larger morainic fragments. When the outflowing glacial waters were of greater volume and faster flow, coarser particles could be carried and deposited away from the ice front. Of such origin are the sand plains, outwash gravel aprons, glacial river terraces and valley trains. But associated with these coarser soils are found areas of very fine grained and dense lake clays, deposits in quiet waters of temporary or higher level lakes and ponds of the glacial period. These outwash and lake bottom soils have in general a lower topographic position than the other glacial material, consequently they are nearer the level of the underground water table. This often insures them a water supply where in other positions such coarser soils would drain and dry out too rapidly. Consequently a heavier type of crops can be grown on many of these soils than would otherwise be possible. The sorting action of water has further resulted in a separation of a much greater number of textural grades of soils than in the till-covered areas, and has arranged them in much more definite groups and bands. This combination of conditions gives a great opportunity for specialization in different crops within comparatively narrow areas. On the lake clays wheat, hay, oats and grapes thrive. The clay loams are available for intensive dairying, as they are unexcelled grass lands, and are also adapted to wheat. The loam group, including gravelly and stony loams, is perhaps the most typical of the soils of this region; such are very important for canning-vegetables, producing large yields of fine, firm quality. (Fig. 5.) These are also some of the best fruit soils, especially for apples and pears. Sugar beets and tobacco do well on the sandy loams, as do also peaches. The sandy soils are best for potatoes, strawberries and early vegetables.

[37] Whitney, M.: The Use of Soils East of the Great Plains Region, *Bur. of Soils Bull. No. 78*, pp. 95 and 129, U. S. Dept. of Agric.

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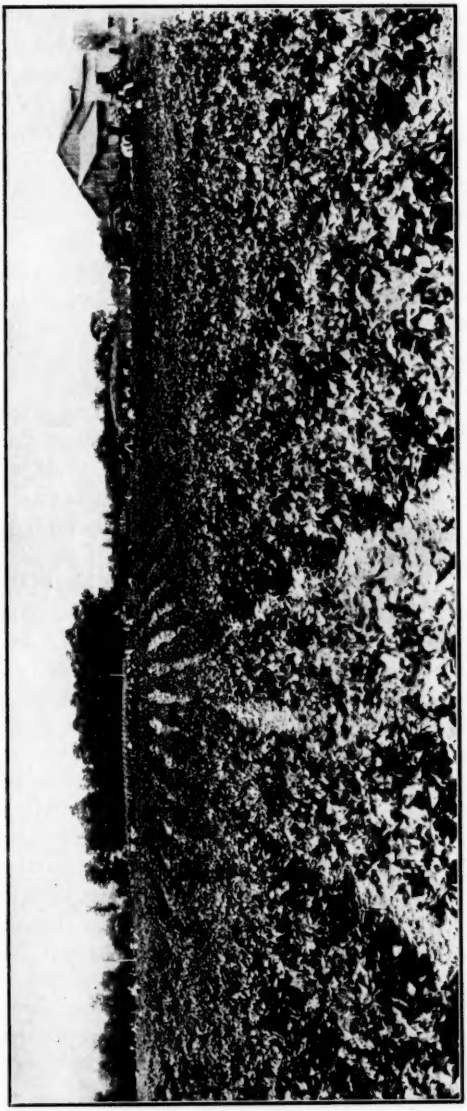

FIG. 5—Harvesting Field Beans from Broad Fields on Outwash Gravel Plain near Cortland, N. Y.

It would manifestly be impossible within the limits of this paper to consider this topic in full in its regional aspects. Several areas, however, have had their crop production so definitely determined by the typical sandy-gravelly nature of glacial outwash material as to merit special mention. In Maine, Ireland, Denmark and East Prussia glacial outwash features predominate, and on the sandy soils characteristic of such origin these regions produce potatoes in large quantities and in large yields per acre. To such a degree is this true that the dependence of the Irish and Germans on the potato for a chief food staple is proverbial. Latterly the sugar beet also has been very successfully grown on such soils, especially in Prussia. On the other hand, a large part (nearly one-sixth of the state) of the northern region of the southern peninsula of Michigan, comprising such sandy soils, formerly covered with great forests of white pine, have, since the complete cutting of the forest and the destruction of its humus floor, developed into infertile "pine barrens," at present practically worthless.

It would probably be difficult to demonstrate whether, on the whole, agriculturally similar regions within or without the glaciated areas have the more diversified soils. That the glacial soils, however, are sufficiently diversified in texture to afford possibilities for growing a wide range of products within narrow areal limits is clearly shown. Moreover, in the glaciated regions, the heavy soils, suitable for the heavy cereal crops, the staples of agriculture, predominate to a marked extent. As a matter of comparison it is, however, interesting to note that in the United States south of the glacial belt there are in the Coastal Plain Province highly diversified soils, mostly light in texture. Over the Piedmont Province the soil types are remarkably uniform, and this is true also of the soils of the limestone valleys of the Appalachians, as it is for the soils of the river flood plains. On the Appalachian plateau uplands and mountains the soils are more diversified, but of comparatively low agricultural value. Accordingly the valuable non-glacial soils in the United States east of the Mississippi seem to be predominatingly uniform in texture over large areas, though if all the different provinces are considered, a wide range in texture is encountered. On the other hand the soils of France are highly diversified in character within a comparatively small area.

(*d*) *Loessial Soils.* Although they are in general peripheral to the glaciated areas and have been included with the till sheet soils in the discussion of textural characteristics, the loessial soils de-

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serve a special mention in this paper on account of their unique nature and high fertility. Their occurrence adjacent to the glaciated regions is probably due to wind transportation of the finer particles of material from wide areas of mud flats, alternately wet and dry, formed by slow-moving and aggrading waters from the glacier fronts; flowing in shallow floods during periods of melting and disappearing almost wholly at other times. Thus loess is spread over the valleys and adjacent uplands of northern France and Belgium, of central Germany, and, extending into Russia, forms the substratum of the famous *chernozem,* or black earth, region, which constitutes the great wheat growing section of that country, the areas that were invaded by the melting waters flowing away from the ice fronts. Similarly, in the United States the loess is found extending far to the south of the glaciated areas and bordering the Mississippi and Missouri Rivers, through whose basins enormous quantities of glacial waters must have flowed during the various stages of the ice advances and retreats.

In texture the loess is coarser than clay, but finer than the finest sand. Its origin in the humid agricultural areas adjacent to the glaciated areas is indicated by its mineral composition, which includes angular, undecomposed fragments of calcite, dolomite and feldspar, products of glacial grinding of a size available for wind transportation. Chemically the loessial soils are, therefore, very rich in lime and to this their great fertility when well watered may be, at least in part, ascribed as may also their enduring qualities. In the subhumid region of the United States it is the most valuable soil type. The loess-covered counties of eastern and southeastern Nebraska produce most of the corn, wheat, oats and alfalfa grown in the state and are the most fertile areas within its boundaries.

4. Effects on Agriculture due to Hydrographic Phenomena Resultant from Glaciation

(*a*) *Glacial Lakes and their Effects on Local Climates and Agriculture.* Areas invaded by the continental glaciers are significantly characterized by the large number of lakes and ponds which dot their surfaces. The typical glacial lake regions of Europe, Finland, southern Sweden and the Norwegian and Scottish fiords and lochs lie outside the agriculturally important areas and have, therefore, no important bearing on this discussion. Many of the larger bodies of water, notably the Great Lakes, of the glacial lake region of North America, however, lie well within the agricultural

province of the southern portion of the district. Over the whole district it has been computed that lake waters cover 16 per cent. of the surface[38] and this figure does not take account of many small lakes not represented on available maps. Therefore, since the larger lakes lie to the south, it is evident that an even larger percentage would need to be stated to express the relative extent of water and land within the agriculturally available portion of the district.

The importance of this as an effect of glaciation on agriculture is, from one standpoint, self-evident. If from 16 to 20 per cent. of the land is covered by water that much area is lost to crop production.

It does not follow, however, from this, that the total loss to agriculture may be measured by a similar percentage. It may even be true that the net result of the glacial creation of these lake basins represents a net agricultural gain, if transportation facilities are considered a factor. Certainly, also, their presence favorably influences the agriculture of the lands adjacent to them by modifying the climate and thus making possible the profitable production of crops which could otherwise not be successfully grown in the same latitude.

Where bodies of water of considerable area exist they exert an important equalizing effect on temperature. Water absorbs more heat, holds more heat, is warmed to greater depths, absorbs and radiates heat more slowly than land. Further, 50 per cent. of the insolation on water areas is used in evaporating water. This develops a moist blanket of air above and adjacent to the water surfaces that is less subject to marked temperature fluctuations than dry air. The total effect of these differences is to make summers cooler, winters warmer, to prolong the fall season and retard spring, and, also, to check sudden temperature changes in short time periods. This last is especially important in the northern belt of prevailing westerly winds with its alternation of cyclones and anticyclones, in which the glaciated regions are situated.

These effects are very clearly shown by a consideration of the climatic features of the state of Wisconsin as set forth in a bulletin recently published.[39] As a result of lake influence (and elevation difference) the length of the growing season, from the last killing frost in spring to the first killing frost in fall, averages 171 days for

[38] Bowman, I.: Forest Physiography, 1911, p. 564.

[39] Whitson, A. R. and Baker, O. E.: The Climate of Wisconsin and its Relation to Agriculture, *Univ. of Wis. Agric. Expt. Sta. Bull. 223*, July, 1912, pp. 25–27, 44, 54, 64.

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five stations along the Michigan shore, whereas for five interior stations at corresponding latitudes it averages only 130 days. As the altitude differences in Wisconsin are not great this relation may be ascribed primarily to the lake influence. The Lake Michigan shore section possesses the most equable climate of Wisconsin. Similarly, stations along the Lake Superior shore have an average growing season of 139 days, while those inland, though located farther south, average only 95 days; but here differences in elevation are probably more effective.

The long growing season and high mean summer temperature make tobacco production possible in the southeastern corner of the state, adjacent to Lake Michigan. Even more marked is the climatic influence of the lake on fruit raising. Thus the two Wisconsin peninsulas that project respectively into Lake Michigan and Lake Superior are now experiencing rapid horticultural development, producing apples, cherries, bush fruits, and even peaches. Inland, these crops are impossible or unsuccessful. In the case of the northern, Lake Superior peninsula, growers are warned that the planting of orchards more than three miles remote from the water influence must be regarded as an experiment. In the southern portion of the state, however, fruit growing has proved profitable in many inland areas where even a small lake, of which there are thousands, afforded local climatic protection.

While Wisconsin undoubtedly derives great agricultural benefit from the effect of the glacial lakes on her climate, yet the state is at a disadvantage in that it lies to the windward of the large bodies of water, Lakes Michigan and Superior. Michigan, New York and Ontario derive similar benefits in more marked degree because they lie to the east and south of adjacent large lakes. The southern peninsula of Michigan is peculiarly favored in that it lies between two large bodies of water, Lakes Michigan and Huron (Fig. 6). Here peaches are regularly ripened on a parallel that forms the northern boundary of Vermont. The climate over the whole area of Michigan is insular to a marked degree.[40]

In New York the areas to the south and east of Lakes Erie and Ontario constitute distinct, wide, climatic provinces[41] with longer growing seasons than more southerly parts of the state, and constitute the great apple, grape and nursery growing areas for which

[40] Schneider, C. F., Michigan, in "Climatology of the United States", *Weather Bureau Bull. I*, p. 556, U. S. Dept. of Agric.

[41] Wilson, W. M.: Frosts in New York, *Cornell Univ. Agric Expt. Sta. of the College of Agric. Bull. 316*, p. 532, June, 1912.

the state is famous. In more restricted areas, adjacent to the narrow Finger Lakes of Central New York, the same climatic relations make possible the very successful growing of grapes. The province of Ontario owes in large part its great productiveness for general farming, nursery and fruit growing to the favorable influence of Lake Ontario on its climate. Fully 75 per cent. of all the fruit grown in Canada is produced in the peninsular Niagara district and in the southern part of the province of Ontario.

It must not be understood that, because the horticultural aspect

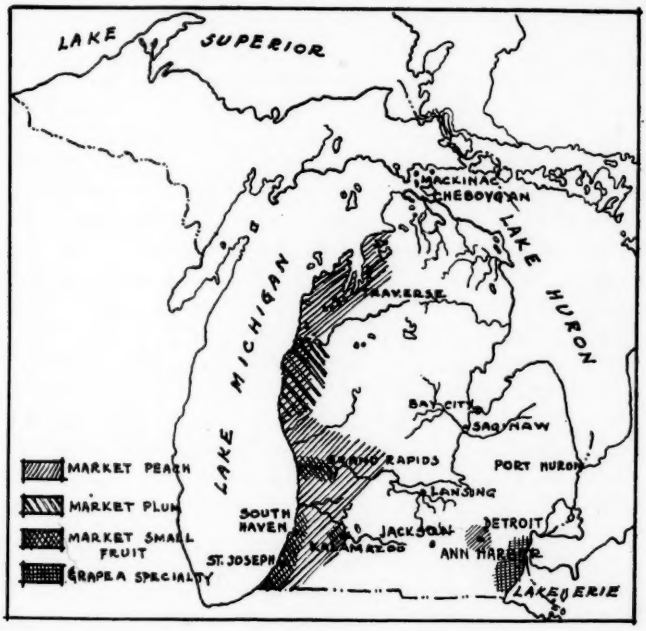

FIG. 6—Distribution of Fruit Crops in Southern Michigan. After W. W. Tracy in "Cyclopedia of American Horticulture," L. H. Bailey, Editor.

is emphasized in this discussion, fruit growing is the only phase of agriculture to which these lake districts are adapted. On the contrary, they produce abundant yields of many other crops. Fruit growing is, however, ordinarily, a precarious enterprise because of the great damage resulting from late or early frosts. For this reason it yields large profits in northern regions where the harvests can be depended on. Therefore, the agricultural value of these lands is

much increased by the equalizing influence of the glacial lakes on climate. Since unseasonable frosts damage other crops as well as fruit, the climatic conditions for these are made more favorable also, and where the modifying factor may not be great enough to protect fruit it may serve to save, in many instances, the hardier crops.

(*b*) *Agricultural Relations of Deposits in Drained and Filled Lake Basins.* The Great Lakes and their forerunners, the proglacial lakes margining the ice on its retreat, formerly extended over much larger areas than they do at present. Thus many acres of land surface in the glaciated area of North America (and also of Europe) are covered with deposits laid down in these lakes. In addition to such extensions of present lakes, there were also large areas, temporarily occupied by lake waters during the retreat of the ice, which were drained, after the ice barrier that prevented drainage to the northward, had melted away. Of these, the former Lake Agassiz, in the basin of the Red River of the North (North Dakota, Minnesota and Manitoba) is the most notable. Further innumerable smaller lakes and ponds that existed at the close of the glacial period have since been filled or drained by natural processes; in addition to the many others that have been reclaimed by drainage operations. In Minnesota it is said that there are 8,000 lakes large and small, and that one-half of these will be destroyed by natural processes within the next fifty years. Similarly in Connecticut of an estimated number of 4,000 lakes that existed after the glacial period some 2,500 have been obliterated.[42]

On the bottoms of these former lakes various kinds of deposits accumulated. While the ice was withdrawing and immediately after its withdrawal, streams flowing into such lakes carried large quantities of sediment, because the freshly accumulated glacial deposits lacked a vegetation cover and were easily eroded, and because great quantities of material were brought by streams outflowing from the ice itself. Therefore, in shallow bodies of water in which currents were readily set up, clays and silts were deposited often over large areas. The effects of this, as bearing on agriculture, was twofold. The previously existing lake bottom topography was leveled up, since the fine grained material tended to accumulate in hollows, because the water was more quiet in these, and because material which settled on slopes occupied unstable positions and tended to slump. This latter effect has been observed by the

[42] Salisbury, Barrows and Tower: Elements of Geography, New York, 1912, p. 400.

writer in recently drained glacial lakes in Alaska, and is also apparent on the slopes of deeper lakes in the regions invaded by the continental glaciers whose hollows were not completely filled before the water was drained off. On the bottoms of the shallower lakes perfectly level plains were developed in this manner. The material deposited was thick, of fine texture, and, except for an occasional erratic dropped by a drifting iceberg, absolutely free of stones. The effects of postglacial weathering and of accumulation of humus from material plant growth, with consequent development of friability, on the surface layers of such deposits, resulted in the creation of a soil of extraordinary agricultural utility.

The floor of former Lake Agassiz previously mentioned, extending over an area of 110,000 square miles (larger than that covered by all the present Great Lakes) is of this character. Much of its expanse is as level as the surface of a calm sea. Furrows miles long may be plowed in deep, rich soil, producing a fine grade of hard wheat. Since 1870, and even now, this region is being developed by a great surge of farming people, attracted from all parts of the United States by its exceptional agricultural possibilities.

The levelness, depth and uniform texture of this soil makes it susceptible of cultivation by machinery on a large scale. As a result of this, and, also, because of the only slightly lesser adaptation of the level glacial till plains to such machine cultivation, the labor cost of grain production has been greatly decreased in modern times. Though areas outside the glaciated regions also offer opportunities for the use of labor saving machines in agricultural operations, yet the glaciated regions, inasmuch as they are the grain producing sections of the northern hemisphere, are largely to be credited for having effected this saving in the cost of our food supply. How much this saving in labor costs amounts to is not generally appreciated. Between 1858 and 1894 the total labor cost of producing a bushel of corn was reduced from 41 cents to 17 cents by this means. Similarly between 1830 and 1896 the total labor cost of producing a bushel of wheat was reduced from 20 cents to less than 6 cents.[43] This increased effectiveness of labor, made possible in large part by the level topography and depth of glacial soils, especially those on glacial lake plains, means a greater food supply at the same cost to offset the rise in population num-

[43] Holmes, G. K.: Agricultural Production and Prices, *U. S. Dept. of Agric. Year Book, 1897*, pp. 600-601. This paper contains many other similar interesting schedules for various crops.

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bers, as the soil can be cultivated more intensively, with higher returns per acre, without the necessity of increasing the number of individuals engaged in agriculture.

On the more porous, well-drained soils, margining the former extension of the Great Lakes, are located in large part the fruit growing areas noted in the paragraphs on climatic relations. These areas represent the beaches and wave-worked material along the former shores.

The smaller lake areas were more commonly filled by vegetation growth. This applies also to lakes and ponds which have been reclaimed by man. These smaller basins are almost all morainic hollows or dammed river valleys. Their drainage basins are relatively small, consequently no great amount of sediment was poured into them immediately after the glacial period. As they often constitute relatively deep pockets with no outlets they are characteristically susceptible to late and early frosts, because cold air, as it forms on the slopes, slides down and accumulates in such hollows. Furthermore, the thick covering of marsh grasses that naturally cloaks their level swampy surfaces prevents the sun's heat from getting to and warming the soil.

While such vegetation-filled, glacial lakes, when drained, have, as a rule, deep rich, black muck soils, this is not always the case. Frequently the organic deposits have not decomposed to the humus stage, are peaty in character, acid and deficient in mineral elements. To make such land available for agriculture requires application of lime. An interesting coincidence is that deposits of lime, in the shape of marl, often occur on the borders or under the vegetable deposits of such lakes and are thus most conveniently available for use on the area.

When skillfully treated such reclaimed muck lands yield most abundant returns in truck crops. Many of the most productive market gardens around the cities of the glaciated regions are on such soils. As instances, those around Chicago, Detroit and Port Huron may be cited. Celery, especially, is an extremely profitable crop on such lands, because it is a truck crop that may be stored and shipped to distant markets. Thousands of acres of these vegetation-filled lake basins still remain to be reclaimed. Because they have not yet been utilized the presence of these areas is not to be considered as a detrimental result of glaciation on agriculture. What they may be worth in the future is well illustrated by the data of one little reclamation project in central New York at Spencer Summit, south of Ithaca. Here 103 acres of marsh land,

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a filled morainic lake basin, were purchased at a cost of $10.00 per acre. At a total expenditure of $3,100 this land was drained. A large portion of it was found to be underlain by marl. At an expenditure of about $11 per week it can be kept drained.[44] Celery, onions and lettuce will be grown. Similar land near Rochester, N. Y., is valued at from $300 to $1,000 per acre. Planted to celery this land will yield returns justifying its valuation at $245 per acre. Thus, by an expenditure of some $3,000, land worth $1,030 has been raised in value to $25,000. While this extraordinary increase is in part due to favorable location, with respect to shipping facilities, and to the low cost of the drainage operations, there is no doubt that a relatively great rise in land value will result from the drainage of many thousands of similar areas, still unreclaimed.

5. Summary

(*a*) Comparisons of the agricultural status of adjacent regions within and without the glaciated regions, whether between broad areas or smaller next adjacent sections, show a consistently higher development in the glaciated regions of dominant drift accumulation.

(*b*) Regions of predominant glacial erosion, whose agricultural value was impaired by such action, are climatically or topographically unfit for agricultural development of high order. They are best adapted for a forest crop, and for this sufficient soil remained or has accumulated since glaciation.

(*c*) In regions of very diverse rock structure, along contact lines of igneous and sedimentary rocks and in regions of bold relief, ice erosion resulted in a steepening of valley slopes and the carving of rock basins, giving rise to lakes. The steepened slopes are generally not cultivable, but as a rule support forest growth. They are, also, a detriment to agricultural transportation. In large measure such steepening of valley slopes is, however, compensated for by erosional widening and drift-deposit leveling of valley floors. The formation of lake basins, on the other hand, made large areas unavailable for agriculture. The irregular topography and in some instances the stony material of well-developed morainic ridges are adverse to their agricultural use, as is also the poor air drainage of the intervening hollows. Moraines and other

[44] Data from man in charge.

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drift deposits of such strong expression are not, however, of great areal extent.

(*d*) The extensive leveling, both by glacial erosion and drift deposit, of the minor rugosities characteristic of the normal, mature stage of development of preglacial relief constitutes an extremely favorable influence on agriculture resultant from ice invasion. Flat, upland, interstream areas may in some instances have suffered by modification of relief, in that their residual soils were eroded and only thin, stony soils left in their place by the ice.

(*e*) The average great thickness of the drift deposits and their level topography conserve the ground water supply of the glaciated regions.

(*f*) Glacial soils are more fertile than non-glacial soils; in part because they contain a higher percentage of the soluble mineral plant foods. Great commingling of different rock materials in glacial soils gives more uniform composition and fertility to them than is characteristic of sedentary soils. The level topography of glacial drift plains soils resulted in a deep accumulation of organic matter, which contributes much to their agricultural worth. The dominant textural quality of glacial soils is that best adapted to the production of the staple food crops.

(*g*) The deposits of the younger glaciations which cover the larger part of the ice invaded regions of central North America have a greater crop productivity than the older glacial soils.

(*h*) Owing to the wide variety of conditions attending the deposition of glacial drift, many textural soil types occur in the glaciated regions, providing for diversified and intensive farming within narrow areal limits. The more valuable non-glacial soils are quite apt to be uniform in texture over wide areas.

(*i*) Loessial soils extend the favorable influence on agriculture, due to glaciation, beyond the limits of the ice advances. Some of the non-glaciated areas would probably show even more marked agricultural deficiency, as compared with the glaciated regions, if these loessial soils were not present.

(*j*) In the humid agricultural section of eastern North America from 16 to 20 per cent. of the glaciated areas is unavailable for agriculture because submerged under glacial lake waters. This loss is offset, perhaps in very large measure, by the modifying in-

fluence of such bodies of water on climate. This climatic protection especially favors the production of valuable fruit crops.

(*k*) The level topography, uniform soil texture, the deep humus cover, and often the great areal extent of deposits on drained and filled glacial lake basins affords a soil of great fertility and very susceptible to cultivation by mechanical power. By such utilization of machinery on these areas and, also, on the level till plains, the labor cost of grain production has been very materially reduced. In conjunction with the muck deposits, characteristic of the filled basins of the smaller glacial lakes, are often found marl deposits. These may be used to advantage to correct possible acidity in the muck, in which very profitable crops of vegetables may then be grown.

6. Conclusions

The beneficial effects on agriculture, due to glaciation, are of wide variety and apparently outweigh detrimental influences due to the same cause. As a net result, glaciated lands are, therefore, of greater agricultural value and utility than non-glaciated areas under otherwise essentially similar conditions. It is not feasible, however, to state numerically the order of this difference, because too many unwarranted assumptions would need to be made.

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CAPTAIN KOCH'S CROSSING OF GREENLAND*

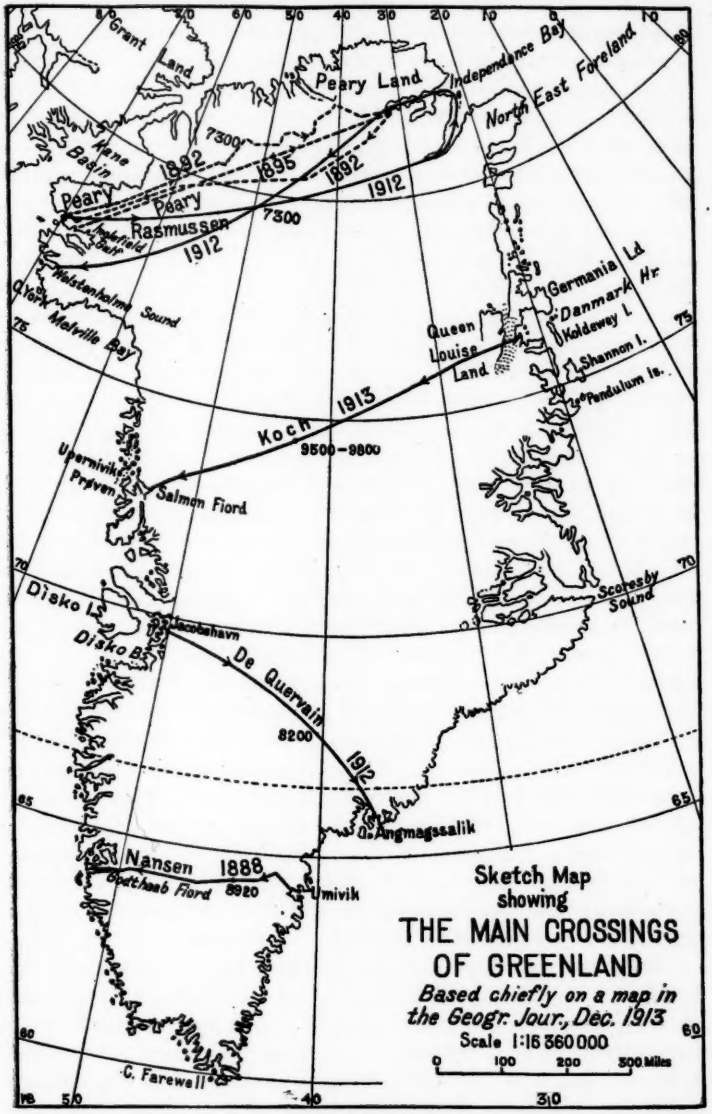
In July, 1912, the expedition consisting of Captain J. P. Koch of Copenhagen, the German Dr. Wegener, the Icelander Vigfus Sigurdsson, and the Dane Larsen, landed at Danmark Harbor on the east coast of Greenland. Thirteen of the sixteen small Iceland horses brought along by the expedition ran away immediately after landing, and Wegener and Vigfus rode off with the remaining horses to find them. They were lucky enough to capture ten. Captain Koch and Larsen were engaged in landing the twenty tons of supplies which the expedition carried. This work was done with the aid of a motor boat and was accomplished with great difficulty, the anchor being lost and the propeller broken during the operation.

Later, in August, the transit became more difficult, the ice closing in on the boat, holding her fast for twelve days, breaking the keel and rudder and eventually sinking the boat itself. Then ice formed and the expedition was obliged to wait three weeks before the ice was strong enough to bear the horses and large sledges. While reconnoitering the Brede Glacier, Dr. Wegener fell and broke a rib. After a few days, however, he was up again and able to participate in the work, and when, on October 13, the expedition settled down for the winter, he had quite recovered.

In order to reach Queen Louise Land, where the expedition intended to winter, it was necessary to build a bridge crossing five crevasses and to cut a passage in an ice wall 130 feet high. On the night of Sept. 30, however, the glacier "calved" and a block of ice a third of a mile wide fell into the fiord on both sides of the spot where the expedition had camped with its horses and supplies. The result was that half of the supplies were destroyed and the newly built bridges were carried away and the driveway was rendered impassable. The men and horses, however, were not injured and, when the ice had finished its movement, the supplies were recovered. It was nevertheless necessary to rebuild the bridges and driveway before the expedition could think of going forward.

In attempting to reach Queen Louise Land, four of the seven

* The Society is indebted to the Hon. Maurice F. Egan, American Minister at Copenhagen, for this summary of a translation of Captain Koch's report of his crossing of the inland ice of Greenland at its widest part from Denmark Harbor on the East Coast to Prōven on the West Coast.



N.B.—The maximum altitudes of the ice cap along the routes are indicated in feet.

sledges were seriously damaged and Captain Koch finally gave up the attempt and established winter quarters at a place called "Storstrømming," nine miles east of the center of Queen Louise Land. It was necessary to erect the house on the inland ice itself. All the horses except five were killed and their meat was used for the purpose of sustaining the remainder. From this time until the end of October, the expedition endeavored in vain to discover a better way to Queen Louise Land.

Captain Koch then had the ill-fortune to experience a second mishap, which he describes as follows: "We had the intention of making a new attempt in November, when the first full moon came, but before that time I fell off an ice wall about fifty feet high and broke my right leg. For three months I was confined to my bed and we could not proceed until March."

The winter was passed quietly. The temperature was —58° Fahr., but did no harm; and, on March 5, 1913, the expedition set out on horseback for Queen Louise Land, covering twenty-five miles in ten hours—the temperature being —40° Fahr. Then at last a sledge road was found that was passable. From March 4 to April 14 the expedition explored Queen Louise Land with the aid of sledges. Then Larsen fell from a snow bridge while crossing a river bed and injured his foot. However, he was almost well again when the expedition, on April 20, left its winter quarters on the long journey, 700 miles or more, across Greenland to the west coast. Captain Koch reports that at that time all the other members of the party were well and in good condition for the march.

Travel over the inland ice was extremely difficult. During the first forty days the party had only two days of fine weather and were obliged to stop for twelve days on account of blizzards. It was often necessary to travel against a wind of high velocity. The horses became exhausted and snow-blind and three of the five had to be killed. The men themselves stood the journey very well, notwithstanding the strong wind and the low temperature. In spite of daily frostbites no permanent injury resulted.

In central Greenland the expedition reached an elevation of 8,200 to 9,850 feet above the sea. The low atmospheric pressure in this region told upon the men and the horses, causing frequent exhaustion. The reflection of the snow was more troublesome, however, than anything else. Everyone suffered from skin peeling from the face and, as the temperature during June frequently went down to —22° and —29.20° Fahr., large wounds appeared on the men's faces. Arctic cramps were often very troublesome.

As the snow was very uneven, the sledges were frequently upset. Later, the snow became so loose that the horses had to be provided with snow shoes. In spite of this precaution they became very much exhausted owing to the poor food. On June 11, one of the two remaining ones had to be killed. At this time the party, having arrived at a place where the land sloped to the west, joined in hauling with the horse in the hope of retaining this last animal, which seemed indefatigable and to which all the members of the party were very much attached. The daylight marches increased in length.

On July 2, they sighted ice-free land, the first they had seen since May 16. But now the temperature rose very suddenly and the expedition emerged directly from the winter of the inland ice to the summer of the coast. At the same time new difficulties arose, the melting snow creating innumerable small lakes connected by deep streams, which rendered impassable for horses the way to the depot, which had been planted for the expedition in 1911. "Therefore," says Koch, "we were obliged to kill our last horse, our good friend in need, after it had traveled with us nearly 700 miles across Greenland, and was then only seven miles from green pastures."

As it was impossible to cross the Salmon [Lakse] Fiord without some special appliances, the expedition constructed from sledges and the covers of their bedding a ferry, which it became necessary to carry a distance of twelve miles to the Salmon Fiord. In carrying out this work the members of the party took with them provisions for five days, but no tents, sleeping bags, or anything else with which to protect themselves.

On July 11, they crossed the Salmon Fiord and proceeded toward Prøven. On the 13th they reached the peninsula Kangek, about twenty miles from Prøven, and were detained by rain, fog and snow. They built a cover after the Eskimo fashion, of rocks and moss and lay there for thirty-five hours without food, their last provisions having been exhausted. The weather cleared on the 16th, and the party desired to proceed, but were prevented by exhaustion brought on by hunger, cold and exposure. A difficult piece of territory covered with deep snow lay in their path and prevented further progress. They thereupon killed their dog that had traveled with them across the inland ice, cooked the meat and were about to eat it, when they discovered a sailing vessel in the fiord off Prøven. They signaled the boat by means of firing and were fortunately heard by those on board. The boat, which be-

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longed to the Rev. Mr. Chemnitz of Upernivik, thereupon put in and took the party aboard.

The latter part of Captain Koch's report tells of the scientific results of the expedition. The chart of the district west of Danmark Harbor was completed and a rather extended knowledge of the interior of the country, its topography, vegetation and animal life was acquired. The most important parts of Queen Louise Land were surveyed and records of temperature were obtained, with the result that new light has been thrown upon certain natural phenomena heretofore unexplained.

The manner of movement and interior structure of the glaciers were examined and determined by means of many photographs. A large number of meteorological observations were made, which will serve as the foundation for further study. Fata Morganas were for the first time photographed by means of a special telescopic camera. The aurora borealis was photographed with a cinematographic objective after the method of Professor Stoermer. A special study was made of the polarization of the atmosphere and, during the passage across the inland ice, the light or reflecting capacity of the snow was measured. The rainbow was studied at temperatures as low as —30° Fahr. Observations of this sort have never been made before at a temperature lower than —7.6° Fahr. The results prove that the arctic mists consist of undercooled water and not of ice crystals. In addition, a series of photographs and of stereoscopic micro-photographs of the rime-crystals were taken.

Captain Koch says that, while the scientific work was concentrated on a comparatively few matters, the observations on these were very thorough. He also mentions the fact that he found traces of snow sparrows and of polar foxes in the center of Greenland, at more than 300 miles from the nearest exposed land.

JOINT MEETING OF THE AMERICAN GEOGRAPHICAL SOCIETY AND THE ASSOCIATION OF AMERICAN GEOGRAPHERS

These societies held their first joint meeting in this city on Friday and Saturday, April 3 and 4, 1914. The meeting was most successful in attendance and in scientific and social interest. Nearly one-half of the members of the Association were present, which is remarkable considering that many of them live in the central and western parts of the Union and their annual meeting was held at Princeton, N. J., only three months earlier. The entire house of the Society was thrown open to the visiting members of the Association who were also our guests at the Park Avenue Hotel and at two mid-day luncheons. A large number of maps, especially arranged for the inspection of the visitors, included specimens of the topographic survey sheets issued by all the governments producing them; also notable recent maps mentioned in the Geographical Record (p. 365) in the notice of the latest exhibition the Society has arranged for the public.

Vice-President John Greenough welcomed the Association at the opening session on Friday morning with the following remarks:

"*Gentlemen of the Association of American Geographers:* It is a matter of great regret to our President, Mr. Archer Huntington, that absence from the city prevents him from receiving you here to-day, and it, therefore, devolves upon me as Chairman of the Council to bid you welcome on behalf the American Geographical Society to our modest home. We trust that this meeting—the first of the annual gatherings proposed under the treaty between our respective organizations—may prove to be the initial step in an enduring coöperation for the promotion of geographic knowledge and effort in this city and elsewhere. I am aware that in addressing you I speak to a body of gentlemen who have already achieved distinction in the field of science where our own members can claim at best only to be students and scholars; and I should, therefore, not attempt in any case to take part in your scientific discussions.

"But it has seemed to me that it would not be thought out of place if I state with frankness what advantages we hope to contribute and what to receive in the *quasi* alliance between us. We may claim, I think, that our Society's aims are absolutely altruistic and free from any possible influence of personal exploitation in the administration of the valuable plant and resources which the generosity of many benefactors has entrusted to us. Our desire is to make of these implements the best use possible in the cause of education in the science to which all of us present are devoted. We possess here a building fitted for the use of literary workers, with a reference library of nearly 50,000 books and 30,000 maps, whilst the labors of an efficient and zealous staff are directed to increase and improve these facilities and to keep in touch with kindred societies throughout the world. You gentlemen of the Association possess experience and attainments which we feel may be of great use to us in realizing the aspiration to which I have alluded and I avail myself of this occasion to express the earnest wish of our Society that you will not regard the limitations of the agreement between us as defining completely our relations,

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but that you will favor us with suggestions if at any time we can be of service to you in any manner whatever, or if action or endeavor on our part in any direction may be of advantage to the cause of geographic science.

"Some suggestion in this direction has already presented itself in an informal consideration of the possible value of a concerted inquiry into the methods of geographic instruction in the schools, and in time to come we should like to hope that similar efforts for the general advantage might crystallize and take shape through our mutual relations. In these very brief and crude remarks you will readily gather that I am endeavoring to outline the spirit and not the form which we invoke for our future. We have had already abundant reason for assurance that we have not misinterpreted a similar cordial feeling on your part, and we have already taken advantage of it to seek guidance not long since in matters that concerned us, receiving valuable advice which this is a suitable place to acknowledge.

"And now in conclusion I may be permitted to add a word regarding our own field of effort and accomplishment. Working in the great metropolis of commerce and finance we are bound to be confronted with the fact of many material considerations which tend to engross the attention of local residents to the exclusion of other considerations. But, notwithstanding this condition, there is to be seen on every side evidence that a spirit of idealism does exist in this community, which finds expression in widespread support of every form of endeavor for human uplift and ethical or intellectual development. In our own organization for instance we number some 1,150 Fellows, who loyally second the plans of their Council to afford a suitable nucleus around which may gather any and all affiliated interests or material which present themselves in this city. Our scheme of influence includes facilities for study, lectures, publication and correspondence. In this unambitious, but, as we think, useful rôle we have continued for sixty years, and we are encouraged by evidences of appreciation in the necessarily restricted circle devoted to our theme. Among the most gratifying incidents of our recent experience, we are glad to record the agreement with your learned and active organization, which opens, as we hope, a path of extended coöperation accompanied by increasing usefulness and mutual respect.

"Welcome gentlemen to our dwelling and to our city. We do not own the latter, but we venture the invitation, for in spite of all its failings, this is conceded to be a hospitable and open town!"

Professor Charles R. Dryer, Vice-President of the Association of American Geographers, responded as follows:

"*Mr. President:* In behalf of the Association of American Geographers, I wish to return hearty thanks for the generous welcome which you have just given us. We would all like to express directly and personally our appreciation of your hospitality and our sense of the good fortune which you are bringing us to-day. This seems to me something like a week-end house party, to which are thrown open all the resources of a great mansion and estate, provided especially for us by the solicitous care of our hosts. I have now enjoyed the hospitality of the American Geographical Society for a longer period than most of my colleagues. I know whereof I speak when I say that it means boundless privilege and unremitting attention.

"I am sure that we all feel a sense of pride and satisfaction in that we

meet to-day in this home of geography. Here our science is not the vassal of geology, history or commerce, but an independent, sovereign state. Here we geographers are not visiting our cousins or our aunts. We are not poor relations from the country or rich relations from the city, but we are sons foregathering from afar in the house of the great mother. We feel as though we were youngsters receiving the paternal blessing and presently to be sent out with a Godspeed and an assurance of substantial backing in our efforts to live up to the measure of our opportunities. I am sure it is a serious question with every one of us what we are going to do to justify the confidence placed in us.

"Geography has need of men and women who will devote all their energies to her scientific and academic advancement, and will have little time to make money. She has need also of men and women, who, occupied with other and large affairs, are yet willing to give her a generous share of their ability and means. We have here today a company composed of both sorts working in harmonious coöperation. No event could be more auspicious for the future of our science. I believe that this meeting marks the beginning of a new era of great undertakings and accomplishments in American geography. That it is a reality and not a dream, we gladly yield to the American Geographical Society full credit, and to you, Sir, again with one accord, thanks."

The audiences at the three sessions in our lecture hall on Friday morning, Friday afternoon and Saturday morning included a considerable number of professors and students from Columbia and New York Universities and Barnard College. The following papers were read at these sessions, all illustrated:

W. H. HOBBS: Land Sculpturing in Arid Lands with Observations from Northeastern Africa.

T. WAYLAND VAUGHAN: The Platforms of Barrier Coral Reefs.

D. W. JOHNSON: Botanical Phenomena and the Problem of Coastal Subsidence.

E. W. SHAW: Characteristics of the Mississippi Delta in the Light of Comparative Studies of Some Old-World Deltas.

OLIVER L. FASSIG: The Period of Safe Plant Growth in Maryland and Delaware.

FREDERICK J. TURNER: Geographic Influences in American Political History.

J. RUSSELL SMITH: The Tree as a Factor in Man's Adjustment to Hilly and Rocky Land.

W. W. ATWOOD: Over the San Juan Mountains to the Ancient Cliff Dwellings of the Mesa Verde.

COLLIER COBB: The Forest of Sunburst: A Study in Anthropogeography.

The audience at the lecture in the Engineering Societies' Hall on Friday evening by Dr. L. A. Bauer, Director of the Department of Terrestrial Magnetism, Carnegie Institution, Washington, included many Fellows of the Society. Dr. Bauer spoke on "The General Magnetic Survey of the Earth," including an account of the work of the non-magnetic yacht *Carnegie* and of the various land expeditions dispatched to many parts of the world. Abstracts of the papers will be published in the *Bulletin* for June and one or more of the papers may appear in these pages later.

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GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

The Cullum Geographical Medal Presented to Miss Ellen Churchill Semple. At the meeting of the Society in Engineering Societies' Hall, on March 24, the Cullum Geographical Medal was presented to Miss Semple in the presence of an audience that filled the large auditorium. In presenting the medal, Vice-President Greenough said:

"LADIES AND GENTLEMEN: It becomes now my pleasing privilege, in your name, to bestow the Society's gold medal of honor upon a distinguished recipient. The science of geography was construed for a long period in a narrow sense, as confined solely to the topographical characteristics of the earth, and the title of geographer was regarded as synonymous with discoverer or explorer. But in time a broader significance was accorded to the term and, in like manner, as the interpreter of hieroglyphics is held in no less honor than their finder, so the function of the geographer was extended to embrace a study of all accessories of physical environment and their meaning. Thereupon its phase of first importance and greatest dignity becomes as indicated in the words of the poet, The proper study of mankind is man. This phrase I take it may be regarded as defining the field of anthropogeography which concerns itself with the inquiry how humanity is affected by the geographical conditions surrounding it in each instance. To this branch of science the medalist has devoted herself for many years and in many lands with a result truly monumental. Her writings and teachings on the subject are recognized both here and in Europe as authoritative and exhaustive and the charm of style and manner in her books creates a sustained interest such as might not always be expected in scientific material. The catalogue of her works is extensive and our Society honors itself in honoring her. I will read the legend on the medal, which is necessarily brief:

"'Awarded to Ellen Churchill Semple in recognition of her distinguished contributions to the science of anthropogeography. 1914.'

"And now, Miss Semple, I ask your acceptance from our Society of this medal. Its inscription is intended as an enduring memorial to your scientific attainments, but I must be permitted on behalf of your many friends to add that it is accompanied by an unwritten appreciation of your personal character, which they all cherish in their hearts."

Miss Semple responded as follows:

"MR. PRESIDENT, LADIES AND GENTLEMEN OF THE AMERICAN GEOGRAPHICAL SOCIETY: I am deeply sensible of the rare and signal honor which you have conferred upon me. The honor is all the greater because of the high standing and high standards of the gentlemen who constitute the Council of your Society, and also because of the distinguished names associated with this medal in the person of its former recipients. The award comes to me as something so unexpected and inexplicable, that it has revived my childhood faith in miracles, and in an instant wiped out all the effects of a perfectly good scientific education. To the research student, absorbed in investigation, his work is so great that it seems to fill the world; his task when accomplished seems so small an achievement that he deems it scarce worthy of comment, much less such recognition as this. Therefore, out of the idealism of the scholar and out of the humility of the worker I speak to you my thanks for your approval and encouragement."

The following named persons, recommended by the Council, were elected to Fellowship:

Cyr. Van Overbergh, Brussels, Belgium,
W. J. Turner Lynch, Larchmont, N. Y.,
Dexter Parshall Cooper, Stamford, Conn.,
Miss Maria Bowen Chapin, New York,
Michael P. Grace, New York,
Outerbridge Horsey, New York,
Myron Reynolds, New York,
Miss Virginia M. Whitfield, New York.

The Hon. George H. Moses, A.M., recently United States Minister to Greece and Montenegro, then addressed the audience on "Greece: The Old and the New." Lantern views were shown.

The Daly Medal Awarded to Prof Albrecht Penck. The Charles P. Daly Medal for Geographical Research has been awarded by the Council to Dr. Penck, Professor of Geography at the University of Berlin. The medal has been forwarded to that city where, on behalf of the Society, it will be presented to Dr. Penck by the Hon. James W. Gerard, Ambassador of the United States to Germany.

The Society's Exhibitions. Among the new exhibits on the racks in our Lecture Hall are collections of views of Constantinople and Bermuda, and a selection of modern maps and atlas sheets each distinctive in its field. They include maps of parts of Asia and Africa published by the British, French, German, Japanese and Russian War Offices; the sheets so far published of the International Map of the World; examples of route surveys; recent maps of the oceans; recent noteworthy economic and anthropogeographic maps; and a series of physical maps of the continents.

The Society's exhibitions are open to the general public from 10 A. M. to 5 P. M. on week days and from 2 to 5 P. M. on Sundays.

Legacy to the Society. The late Hermann C. von Post, whose long and valued services to the American Geographical Society as one of its Fellows and a member of its Council were referred to in the *Bulletin's* notice of his death (January, 1914, p. 54), left the Society a legacy of $10,000.

NORTH AMERICA

New York State Board of Geographic Names. A law was passed on April 23, 1913, by the legislature of New York (Chapter 187, amending Article 10 of Chapter 23 of the laws of 1909 and designated Section 110) creating a board to pass on the correct form of all geographical names within the state. For the copy of this law reprinted below the Society is indebted to Dr. John M. Clarke, state geologist and secretary and executive officer of the board.

110. Board of Geographic Names; Powers and Duties. A state board of geographic names is hereby created, to consist of five members, of which the commissioner of education and the state geologist shall be ex-officio members, and three of whom shall be appointed by the governor to hold for terms of two, four and six years, to be designated by him when the appointments are made. Their successors shall be appointed by the governor for terms of six years. Vacancies shall be filled by the governor for the unexpired terms of the offices vacated. The state geologist shall be the secretary and executive officer of such board. All of such members shall serve without compensation. The said board shall have power, and it shall be its duty:

1. To determine and establish the correct historical and etymological form of the place names in this state and to recommend the adoption of such correct forms for public use.

2. To determine the form and propriety of new place names proposed for general use, and no corporation, individual or community shall introduce such new place names without the consent and approval of this board.

3. To coöperate with the United States board of geographic names and with the United States post-office department in establishing a proper, correct and historically accurate form for all place names proposed as designations of new post-offices.

Mississippi Floods. In a monograph on the Mississippi floods of 1912 (The Ohio and Mississippi Floods of 1912, by H. C. Frankenfield, *Bulletin Y*, U. S. Dept. of Agric., Weather Bureau, Wash. 1913), Professor Frankenfield discusses the relative importance of four great floods, those of 1882, 1897, 1903 and 1912. He arrives at the conclusion that in amount of rainfall the 1882 flood exceeded the others, but in stage of river and in duration above flood

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stage the 1912 excelled. In striking the balance of these, he assigns the first place in the flood history of the Lower Mississippi valley to the flood of 1912. It is a question whether any value can be placed upon this conclusion. Stage of river and flood duration during the flood of 1912 was measured under different conditions from those of earlier floods as a result of the constant growth of levees and the impounding of the waters so that it may be expected that floods of less rainfall may in late years exceed in these particulars floods of more rainfall of early years. The amount of precipitation must be a main factor in estimating floods, and with this the conditions affecting run-off is a safer guide, so long as the character of the high water trough is changing, than stage or duration. The *Bulletin* contains a clear statement of property losses during the flood, and includes forty-one diagrams and charts illustrating the climatic conditions and the water stages during the four floods.

ROBERT M. BROWN.

The Second Ascent of Mt. Robson. On July 31, 1913, Conrad Kain, a Swiss guide in the employ of the Alpine Club of Canada, with Mr. W. W. Foster, Deputy Minister for Public Works, British Columbia, and Mr. A. H. MacCarthy, made the second ascent of Mt. Robson. The first ascent by the Rev. George Kinney was described in the *Bulletin* (Vol. 42, 1910, pp. 496-511). Mr. Kain, writing of his ascent (*Alpine Journal*, No. 203, Vol. 28, 1914, pp. 35-38) describes the summit as "nothing but two big cornices of snow meeting at an angle." The view, he says, is very fine but, as experienced mountain climbers know, one can never expect the best view from such a height. The temperature he thinks must have been below zero. He adds that the snow conditions on the highest peaks in the Canadian Rockies can never be compared with those in the Alps as there are more avalanches in the Rockies on account of the dryness of the atmosphere which leaves the snow powdery and unpacked. Mt. Robson, he thinks, will always be a risky climb, even on the easiest side, on account of avalanches.

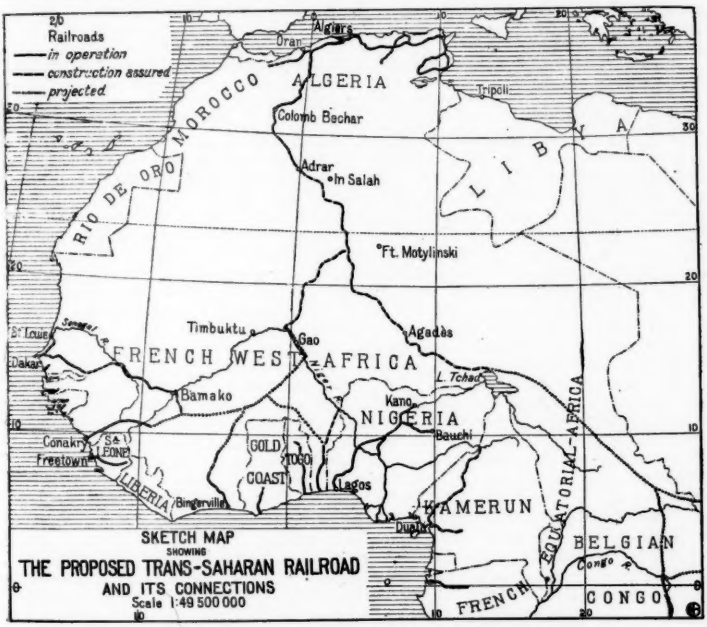
Mr. Stefansson Honored by the American Museum of Natural History. Mr. Vilhjálmur Stefansson, in recognition of the important explorations that he has carried on and his contributions to the sciences of geography and ethnology, has recently been made an Honorary Fellow by the Trustees of the American Museum of Natural History. This is the highest honor that it is within the power of the Museum to bestow and has been awarded to but seven other persons during the history of the institution.

International Ice Patrol Service. The United States Revenue Cutter *Seneca* is carrying on the international ice observation and ice patrol service provided for by the recent London conference. The *Seneca* left New York on Feb. 19, proceeding toward the east of Newfoundland, locating ice fields and icebergs, observing the quantities, kind, extent and drift of the ice and obtaining other information that may be of value. The object of the patrol is primarily to ascertain the location and progressive movement of the limiting lines of the areas in which icebergs and field ice exist in the neighborhood of the Grand Banks and the dissemination of this information for the guidance and warning of navigators. The service also includes such oceanographical and meteorological observations as may help to explain the causes that determine the position and extent of the ice. The *Seneca* endeavors to send a daily message to the coast radio stations for distribution, and also to keep ships at sea advised by daily radio messages of the limits of the ice fields, etc. (*Hydrogr. Bull. No. 1231*, March 18, 1914).

AFRICA

Results of the French Transafrican Railroad Mission. A party of French officers led by Captain J. Nieger spent ten months from Jan. 17 to Nov. 18, 1912, in preliminary surveys for a railroad intended to connect southern Algeria with the Lake Chad district and the central valley of the Niger

River. This investigation resulted in the recommendation of a route starting from Adrar (northwest of Insalah) and extending in a southeasterly direction over the southern edge of the Tademait plateau to the Haret valley. Beyond Imedden-Azarif the line assumes a southerly course in its passage through the valley separating the Ahenet, Emmidir and Ahaggar uplifts. The Niger River branch is projected to start in the valley of the Tamanraset, southwest of Silet and to pass west of the Adrar mountains, the Niger being attained at Tosaye, east of Timbuktu, between Bamba and Burem. The main line itself is to proceed east of the Adrar Mts. and strike towards Agades between the shifting sand dunes of the Tenere district. Thence a decided southeasterly course to the marshy region immediately north of Lake Chad will be maintained.



Based on a map in *La Géographie* for Feb. 15, 1914.

N.B.—The railroad between Colomb Bechar and Adrar should be indicated by dashes; also the Bauchi branch of the Nigerian railroad.

From the account of this expedition, as recorded by its leader in *La Géographie* (Feb. 15, 1914, pp. 73-109), it appears that valuable data on the orography of the central Sahara and the district immediately northwest of Lake Chad have been collected. A sketch map of this region based on all available earlier work and containing the data obtained by the railroad mission has been issued on a scale of 1:4,000,000. It is particularly informing as to the distribution and extent of shifting and stationary sand dunes and the location of the isolated granitic blocks. Particular attention was given to hydrography.

The line, as surveyed, has a length of 2,093 miles. Engineering problems will present no serious obstacles. Cuts and fills are small, the profile showing favorable evenness. The steel tracks will carry railroad penetration into the heart of Africa from Colomb Bechar, the present southernmost station of the French railroads. Observations confirm the error of regarding the Sahara as a

vast sandy desert. Explorations have revealed the fact that barely a quarter of the desert is covered by sand. Further knowledge of the wind régime of the entire region is needed, however, as during the windy season sand is transported over large areas, sand dunes being formed in every direction whenever a genetic nucleus occurs. The determination of the routes followed by air currents is therefore a study of prime importance in its relation to the possible difficulties to which railroad operation in the Sahara would be subject.

Besides the 1:4,000,000 map mentioned above the following cartographic documents have been compiled by the mission: (1) a 19-sheet map (1:400,000) of the region traversed by the projected railroad; (2) a 1:100,000 plan of the right-of-way between Ahaggar and Lake Chad as well as between Ahaggar and the middle Niger; (3) a profile and several cross-sections of the 1:100,000 plan. These surveys are supplemented by detailed reports on geology, geography, hydrography and meteorology.

Prof. Fritz Jäger's Mission to German Southwest Africa. Prof. Jäger started late in February for explorations in German Southwest Africa under the auspices of the German Colonial Office. He was accompanied by Dr. Waibel. He went first to Cape Town to travel through Cape Colony and investigate the economic conditions in that country, which in many respects resembles the German colony though its development is more advanced. He hoped to gain there points of view that may be valuable in the development of German Southwest Africa. His first work in that colony will be in the region of the Etosha Pan and the Karst region to the south of it for the purpose of hydrographic investigations. It is now known that in this region are underground lakes and it is of great importance to ascertain how far they may be available for the development of the land surface above them. From these investigations he will proceed to the northern part of the Kaoko Feld to draw a number of profiles to the coast and study the continental mass where it breaks down to the sea. Then he will investigate the limestone pans of eastern Damara Land described by Michaelsen in the *Mitt. aus den Deutschen Schutzgeb.* (No. 3, 1910). A systematic investigation of these limestone pans is much desired as they are the most important source of water for the cattle industry in that region. Jäger will everywhere give as much time as possible to geological and topographical investigations. Dr. Waibel will devote himself chiefly to plant studies, beginning his work before the arrival of Jäger and continuing it after Jäger's departure. (*Zeitschr. Gesell. für Erdk. zu Berlin*, No. 2, 1914, pp. 153-154.)

Incorporation of the Mayotte-Comoro Islands with Madagascar. The *Temps* of March 3, 1914, announces the promulgation of a decree, dated Feb. 23, 1914, which definitely ratifies the law of July 25, 1912, whereby the islands of Mayotte, Anjouan, Moheli, as well as Comoro and its dependencies, are henceforth to be administered as parts of Madagascar instead of as separate colonies. The change is due to the growth of commercial relations between the archipelago and Madagascar.

ASIA

Himalayan Glaciers. The Geological Survey of India is undertaking the systematic observation of the Himalayan glaciers (*Records Geol. Surv. India*, Vol. XXXV, 1907, pp. 123-157; *ibid.*, Vol. XL, 1910, pp. 52-62). This important work, undertaken in 1906 at the suggestion of Mr. D. W. Freshfield of the Commission International des Glaciers, has involved the mapping of fifteen glacier termini in Kashmir and Sikkim on the scales of one inch to 400 feet and one inch to 800 feet and the taking of photographs from marked stations. Future observations with the aid of these photographs and maps should determine the behavior of the glaciers with precision. It is already clear, from comparison of certain glaciers in 1906 or 1909 with the observations of the same ice tongues by Freshfield in 1899, Garwood in 1902, Conway in 1892, Hooker in 1854, and others, that many ice tongues have been long inactive. The Hispar Glacier retreated several hundred yards from 1892 to 1906.

Two ice tongues, however, have had notable advances. The Yengutsa Glacier moved forward at least two miles in 1901, covering cultivated fields. The Hassanabad Glacier had an advance about 1903, moving forward six miles or more, as observed by a native prince whose villages were threatened. This advance took place in two and a half months and the glacier had subsequently receded slightly, but it had had earlier oscillations.

It is to be hoped that these Himalayan glaciers may be revisited frequently, for they seem to show the same brief spasmodic advances of great magnitude separated by long periods of inactivity that have recently been observed in Alaska. In young mountains like those of northern India the suggestion of the earthquake-avalanche cause for these glacial advances can be tested. It will take frequent observations, however, for otherwise a brief period of activity may be overlooked. In Alaska, for example, we now know of over fifty cases of ice tongues which have advanced during the last fifteen years and have chanced to be observed through the opportune visit of some geologist or other traveler. Doubtless scores of other temporarily active glaciers have escaped observation. L. M.

AUSTRALASIA AND OCEANIA

Improvements at the Harbor of Sydney. According to *United Empire* (Vol. 5, 1914, No. 2, p. 160) over $30,000,000 are to be expended on improvements at Sydney Harbor, which is to be partly remodeled. Large additions are to be made to the wharfage. The new wharf frontage will be 42,600 ft. providing accommodation for 71 vessels each 600 feet in length. This great harbor development has been rendered necessary by the enormously increased traffic resulting from the agricultural development of New South Wales.

EUROPE

Adoption of the Greenwich Meridian in France. According to *La Géographie* (Feb. 15, 1914, p. 134) the Société de Géographie is in receipt of information regarding the adoption of the Greenwich meridian by the French Hydrographic Office, beginning with Jan. 1, 1914. Charts published after that date will conform with the general usage in this respect. They will thus acquire greater serviceability for use in conjunction with standard astronomical data which are commonly based on the Greenwich meridian as the initial longitude.

Change of Title of a Scandinavian Geographical Journal. Beginning with the volume for 1913, the *Geografiska Föreningens Tidskrift*, published six times a year by the Geografiska Föreningen i Finland of Helsingfors, changed its title to *Terra*. To those interested in geographical bibliography it may be well to recall the names of the remaining Scandinavian geographical journals, inasmuch as similarity of title may lead to confusion. The same association in Helsingfors also issues at irregular intervals a publication containing scientific papers which is entitled *Meddelanden af Geografiska Föreningen i Finland*. The other geographical society of Helsingfors, the *Sällskapet för Finlands Geografi*, publishes at irregular intervals the well-known journal *Fennia* with the French sub-title *Bulletin de la Société de Géographie de Finlande*. The remaining Scandinavian geographical journals are: the *Geografisk Tidskrift*, published in eight numbers to the volume, which covers two years, by the Kongelige Danske Geografiske Selskab of Copenhagen; *Det Norske Geografiske Selskaps Aarbok*, an annual issued by the Norwegian geographical society of Christiania; *Ymer*, published four times a year by the *Svenska Sällskapet för Antropologi och Geografi* of Stockholm; and, finally, the new *Meddelander fran Geografiska Föreningen i Göteborg*, begun in 1912 and to be continued at irregular intervals, published under the auspices of Prof. Otto Nordenskjöld of the University of Göteborg by the geographical association of that place.

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PHYSICAL GEOGRAPHY

Geologische Charakterbilder. Edited by Dr. H. Stille. This series of illustrations of characteristic geological features is being published in parts, each consisting of six to eight plates with brief descriptive texts. They have as much interest to physical geographers as to geologists. They present striking features from all parts of the world and have been contributed by many geologists and physiographers. The views are reproduced most admirably; the text is in the language of the author. Nineteen numbers have already been issued by the publishing house of Borntraeger Brothers in Berlin, the last six of them in the summer and autumn of 1913. The following is a list of titles and authors of the numbers so far issued:

1. Icebergs and inland ice of Antarctic region,	E. Philippi.
2. Great erratic blocks in North German Lowland,	F. Wahnschaffe.
3. Karst phenomena,	A. Grund.
4. Morphology of French Alps,	W. Kilian.
5. Morphology of the northern Adriatic and of Istria.	Goetzinger.
6. Gneiss of northwest Greenland,	A. Heim.
7. Basalt and sedimentary deposits of west Greenland,	A. Heim.
8. The escarpment of the Odenwald near Heidelberg,	Spitz and Salomon.
9. The Carinthian southern Alps,	G. Geyer.
10. Karren in Alps of Switzerland,	Heim and Arbenz.
11. Sandstone pinnacles, western United States,	N. H. Darton.
12. Silica and lime deposition, western United States,	N. H. Darton.
13. Caledonian thrust region of Swedish Lapland,	W. von Seidlitz.
14. North border of middle Suabian Alps,	R. Lang.
15. Morphology of French Alps, No. 2,	Kilian and Reboul.
16. Lava fields of Kilauea, Hawaii,	A. Heim.
17. Arid regions of Algeria,	S. Passarge.
18. Recent river deposits in the northern Argentine Andes,	H. Keidel.
19. The terminal moraines of the North German Lowland,	F. Wahnschaffe.

About 150 carefully selected views are given in these numbers and many of them are new and very instructive. The Alpine pictures have diagram oversheets on tracing paper, which add greatly to their usefulness, and several of the texts contain maps and cross sections explanatory of the pictures.

N. H. Darton.

EDUCATIONAL GEOGRAPHY

Geography in the Summer Schools

The institutions mentioned below will send their summer school announcements to those interested.

Illinois. Eastern Illinois State Normal School, Charleston, Ill. Three courses in geography: Geography of Northern Europe; Physiography; a lecture course covering types of work included in the Illinois state course of study.

Illinois State Normal University, Normal, Ill. Two terms: June 8 to July 17; July 20 to Aug. 26. Nine courses: The Land, the Ocean, the Atmosphere, Mathematical Geography, Mr. Russell; Method in Geography, Mr. Ridgley; Home Geography, Miss Stark; Intermediate Geography, Miss Robb, Miss McClellan; Geography of North America, Miss Robb; South America, Miss Stark; Conservation of Natural Resources, Mr. Ridgley; Commercial Geography, Miss Stark, Miss McClellan; Geography of Europe, Miss McClellan.

Iowa. State University of Iowa, Iowa City. In the summer session of six weeks a course on physiography will be given including the elements of

weather, climate and atmospheric phenomena with laboratory and lecture methods. Professor Trowbridge will take a small group of men into the field for five weeks when they will return to write up their field notes, prepare outlines, etc.

Maryland. JOHNS HOPKINS UNIVERSITY, Baltimore. Summer courses, July 6-Aug. 13. The work available in geography is limited to such material as is found in the courses in Greek archæology and art, the history of Greece and Rome, and courses on European and American history.

Michigan. NORMAL COLLEGE, Kalamazoo. Land Forms; Climatology; General Geography—a study of type regions by the application of the principles developed in courses 1 and 2 and also the principles of distribution of plant, animal and human life; Commercial Geography; Michigan Geography; Home Geography—The geographical phase of nature study.

UNIVERSITY OF MICHIGAN. (June 29-Aug. 21). A course for teachers and other students on physiography and the relation of the earth forms to the problems of geography, with lectures, laboratory work and recitations, by Prof. Sauer and assistant; Geography of North America, with lectures and assigned readings, Prof. Sauer and assistant.

Minnesota. UNIVERSITY OF MINNESOTA. General Geology, an introductory course covering the whole field, by Mr. Posey; Geography of Eurasia, open to those who take course 1 or its equivalent—a study of the geology, topography, climate, natural resources, people, industries and trade of these countries, Mr. Posey; Field course on the geography and geology of Minnesota, open to those who wish to study Minnesota at first hand. Four weeks June 22 to July 4, and July 20 to Aug. 1 will be spent in the field, Mr. Lehnerts; Field work in the Yellowstone and Glacier National Parks for the comparative study of the geology and geography of these parks, Aug. 3 to Aug. 22, Mr. Lehnerts.

New York. COLUMBIA UNIVERSITY. Physical Geography and Its Economic Aspects—lectures, laboratory and field excursions. Among the topics considered will be some phases of cartography including map projections and interpretation of topographic maps, climatology, oceanography, land forms, and their effects on distribution of population, human occupation, etc., hydrography, etc., with special attention to methods of teaching geography and of conducting laboratory work, Prof. D. W. Johnson and Mr. Knight; Physiography of the Eastern United States, lectures, laboratory and field work, Prof. Johnson and Mr. Knight.

TEACHERS COLLEGE, COLUMBIA UNIVERSITY. The teaching of geography in elementary schools—lectures, reading and discussion, Prof. Dodge; Geography for Rural Schools—lectures, required reading and discussions, including a study of geographic facts and relationships, Prof. Dodge; Man and his geographic environment—lectures and collateral reading, a summary of the fundamental relationships between man and his geographic environment, Prof. Dodge.

NEW YORK UNIVERSITY. Geography of the ocean and atmosphere (Lectures), Prof. Woodman; Geography of the ocean and atmosphere (Laboratory), Prof. Woodman; Principles of economic geography, Prof. Woodman; Economic Geography of Europe, Prof. Woodman; General physiography and geology (Field Course), Prof. Woodman and Prof. Earle; Geology and geography of our National Parks, Prof. Earle; Seminar in Geographic and Geologic Problems, Prof. Woodman and Prof. Earle.

CORNELL UNIVERSITY. Physical Geography, Assistant Prof. von Engeln; Industrial and Commercial Geography—adapted to the needs of teachers in high and grammar schools, Prof. Carney; Geography of North America—designed to give a broad conception of continental evolution and the geographic adaptation of North America for human occupation, Assistant Prof. von Engeln; Aims and Methods in Geography, primarily for normal school and grade teachers—lectures and discussions on such topics as home geography,

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the earth as a planet, mathematical geography, cartography, field lessons, the inter-relations of physical and human geography and the claims of commercial and of regional geography; Physical Geography Laboratory, Prof. Carney.

North Carolina. UNIVERSITY OF NORTH CAROLINA, Chapel Hill. General Geography—dealing with Home Geography and the Geography of North Carolina, with principles, their application, methods of teaching, etc., Instructor John E. Smith; Geography for Secondary Schools; Topographic Forms and their Influence on Human Affairs; Natural Provinces of North Carolina and the United States, historical, commercial and industrial phases emphasized; Laboratory Equipment and Field and Laboratory Methods of Instruction. The classes in geography will make field excursions and industrial trips to mills and factories, Instructor John E. Smith; Advanced geographical field work and special research—a study of the etched peneplain of middle North Carolina in relation to the economic and historical geography of the state with special reference to transportation. This course covers five weeks, one at Chapel Hill and four devoted to field study, Prof. Collier Cobb.

Ohio. OBERLIN COLLEGE. June 26-Aug. 14. Topographic Surveying—consists of practical experience in the mountains with plane table, transit and level, in the methods of making the topographic map.

Pennsylvania. UNIVERSITY OF PENNSYLVANIA. July 1-Aug. 15. Commercial Geography of the United States—lectures dealing with resources, products and industries, supplemented by excursions to industrial plants, George B. Roorbach, A.B., Instructor in Geography; Physical and Economic Geography, special reference to the influence of land forms upon man's activities—the course will consist of lectures and field excursions, Mr. Roorbach; Resources and Industries of South America, a Regional Study of the Continent, Mr. Roorbach.

Wisconsin. UNIVERSITY OF WISCONSIN. Geography of Europe, Professor Lawrence Martin; Regional Geography, Prof. Martin; Elementary Geology, Prof. Martin; Physical and Applied Geography, Prof. R. H. Whitbeck; Industrial and Commercial Geography, Prof. Whitbeck; Field Courses in Geography and Geology, during August, in the region of Devil's Lake, Wis., in charge of Prof. Martin.

PERSONAL

Professor R. E. Dodge, of Teachers College, New York, will give a part of this summer to his duties as editor of the *Annals of the Association of American Geographers.*

Dr. Fuller, of the University of Chicago, plans to take a party of students to the Colorado Rockies for field study in plant geography.

Prof. George D. Hubbard of Oberlin University, will go to Virginia as usual with a party of geologic and geographic students for seven weeks. During the remainder of the vacation he will continue his physiographic studies for the Geological Survey of Ohio.

Prof. E. M. Lehnerts, of the University of Minnesota, will conduct the main party of the National Education Association through the Yellowstone National Park at the close of their convention at St. Paul. The party will leave St. Paul on July 10.

Prof. T. H. MacBride has been appointed Acting President of the State University of Ohio in place of President John G. Bowman, resigned. Prof. MacBride has been connected with the University for thirty-six years, for many years head of the department of Botany.

Mr. François E. Matthes of the U. S. Geological Survey has been elected Corresponding Member of the International Glacier Commission. He lectured at Yale University on Feb. 19 on "Topographic Delineation" and on Feb. 20 on "The Glacier System of Mt. Rainier."

Prof. Lawrence Martin of the University of Wisconsin has been elected a Corresponding Member of the International Glacier Commission. Following the summer school at the University he expects to do field work for the State Geological and Natural History Survey preliminary to writing an educational bulletin upon the geography of the Rock River Valley of Wisconsin.

Mr. J. W. Redway's specific work for the past two years has consisted of a study of the flood plains of the Ohio Valley with reference to recent floods and an investigation of the changes in the Yellowstone Park geyser basins between two visits forty-three years apart.

Mr. E. W. Shaw of the U. S. Geological Survey spent two months of last fall in the continuation of the studies of the Mississippi Delta and of the physiography of the gulf and embayment. Following this he made a reconnaissance examination of some deltas in Europe, Egypt and Syria. His field work this spring and summer will be upon the physiography of Southern Illinois and of the gulf embayment.

Prof. V. E. Shelford, of the University of Chicago, will spend the first half of the summer giving a course in marine animal ecology at the Puget Sound Marine Station, Friday Harbor, Washington; and the second half at the University of Chicago, giving a course in physiographic animal ecology in the University of Chicago, carrying on investigations in both places.

Prof. B. Shimek of the State University of Iowa will spend some time at the University of Prague where he will lecture on plant ecology dealing chiefly with American deserts and prairies. He will visit a few German universities and return in September. He has been invited to deliver two addresses before the meeting of biologists and physicians at Prague.

OBITUARY

Sir John Murray. It is with great regret that the *Bulletin* announces the death of Sir John Murray, the distinguished oceanographer, who was killed in a motor accident near Edinburgh on Monday, March 16. For a generation Sir John Murray had been regarded as one of the greatest authorities on the ocean and its problems. He was born at Coburg, Ontario, in 1841, the second son of Robert Murray, an accountant. When seventeen years old he went to Scotland to complete his education at the University of Edinburgh, devoting himself to literature under Prof. Masson and to science under Kelvin, Tait and Clerk Maxwell. Mr. Murray became known through his intimate association with the *Challenger* Expedition. He was prominent in organizing and equipping this great enterprise in 1871-72. The *Challenger* explorations were made between 1872 and 1876. Nearly all the seas of the world were penetrated and the expedition practically established the foundations of our knowledge of the ocean and of the enormous area of the globe which it hides from view. Murray devoted himself to the study of the deep sea deposits, the pelagic organisms, the vertebrates and protozoa and had charge of all the collections. The study and working out of these collections and the other results formed a stupendous task and lasted very much longer than the expedition itself. The reports cover 50 large royal quarto volumes. In 1880 and 1882 Sir John Murray took part in the exploration of the Faroe Channel. He was also the chief promoter of the minute exploration of the Scottish lochs, the results of which, with fine maps by Bartholomew, were published several years ago. With Dr. Johan Hjort of Norway, he conducted a deep sea expedition in 1910 in the Atlantic on the research steamer *Michael Sars*, the cruise extending from the coasts of Europe and Africa down to Cape Bojador, across the Sargasso Sea to St. John's, N. F., and eastward across the Atlantic to Ireland and the Faroe Islands. The journey resulted in a large number of temperature and other observations and the collection of many specimens. Throughout his scientific career, Sir John was a large contributor to the literature of the ocean and of some other phases of physical geography. Our Council awarded the Cullum Geographical Medal to Sir John Murray in 1899 in recognition of his many distinguished services to science. The inscription was: "Awarded to Sir John Murray, K.C.B., naturalist, deep sea explorer, oceanographer, editor of the *Challenger* Reports."

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GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

(The size of books is given in inches to the nearest half inch.)

NORTH AMERICA

California Tourist Guide and Handbook. Authentic Description of Routes of Travel and Points of Interest in California. By Wells Drury and Aubrey Drury. 354 pp. Maps, ills., index. Western Guidebook Co., Berkeley, Cal. $1.25. 7 x 4½.

Travelers in California will find this book a helpful guide. It describes in detail the points of interest along the railroad lines of the state. Prospective visitors, in planning an itinerary, would do well to study the Guide for side trips as well as for the main lines of travel. Unfortunately for the best use of the volume the author has neglected to study the needs of the consultant in maps, for a number of these are on too small a scale to be of value. ROBERT M. BROWN.

Early Days on the Western Slope of Colorado and Campfire Chats with Otto Mears, the Pathfinder. From 1870 to 1883, Inclusive. By Sidney Jocknick. 384 pp. Ills. Carson-Harper Co., Denver, Col., 1913. $1.75. 8 x 5½.

A flavor of pioneer days is imparted by this account of the author's experiences among the Ute Indians round about the Uncompahgre Valley between 1870 and 1880. The community, not unlike others in the early days, had its strong men and its unscrupulous ones. Jocknick gives a vivid idea, and without doubt a true one, of his hero, Otto Mears, the pathfinder of the San Juan, and of other men. He devotes chapters to the tragedies of the early days when lawlessness could be easily concealed, while the stories of Packer and Howard, the one a criminal of low type and the other a highwayman, have been repeated probably in many places in the great west. We also find here an insight into the workings of the Indian agencies from the point of view both of the agent and the Indian. The book gives a plain, unpretentious account of an early phase of American life. ROBERT M. BROWN.

The Physiography of the Rio Grande Valley, New Mexico, in Relation to Pueblo Culture. By E. L. Hewett, J. Henderson and W. W. Robbins. 76 pp. Map, ills. *Bur. of Amer. Ethnol. Bull. 54.* Washington, 1913. 9½ x 6.

This is a collection of three papers. The first by Hewett on the Rio Grande Valley, New Mexico, contains a general description of the geological and physiographic features of the region. The second is a more detailed study of El Rito de los Frijoles, a small and somewhat typical canyon valley on the western side of the Rio Grande. This paper presents three major points, the origin and age of the tufa which forms the sides of the canyon, the slow process of erosion as indicated by the positions of ancient pueblos and the steep character of the south facing wall of the canyon as compared with the more gently sloping north wall, a feature which the author attributes to differential frost action. The third paper is by Henderson and Robbins on Climate and Evidences of Climatic Changes. The belief in a slow desiccation of this region is based on historical, botanical and geological evidence. The ruins in the valley point to a considerable population a few centuries ago; these people raised corn where corn cannot be grown to-day; there appear to have been extensive lakes formerly where the ratio of evaporation

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to precipitation does not now permit them; and the glaciers which have disappeared or are receding in the Southern Rockies seem to indicate a change in climate which is probably still in progress. These papers supplement one another and form an interesting and valuable contribution.

ROBERT M. BROWN.

The Conquest of Mount McKinley. The Story of Three Expeditions through the Alaskan Wilderness to Mount McKinley, North America's highest and most inaccessible Mountain. By Belmore Browne. Appendix by Herschel C. Parker. xvii and 381 pp. Maps, ills., index. G. P. Putnam's Sons, New York, 1913. $3.50. 9 x 6½.

This book not only chronicles a feat of mountaineering but also gives to the public the final word concerning the alleged ascent of McKinley by Dr. Cook. The story includes three attempts to scale the peak. The first expedition, in 1906, when Dr. Cook led the party, approached the mountain from the south by way of the Yentna River; the second expedition, in 1910, tried to reach the top from the southeast; and the final expedition, in 1912, attacked the peak from the north. It was a month or so after the failure of the 1906 expedition that Cook announced his success in reaching the summit. The author has inserted convincing proof (if any one needed it) of Dr. Cook's hoax, in the pictures opposite pages 114 and 122 which are taken from the same position as Cook's McKinley pictures, and which reproduce the scenes of pictures printed by him in his book. Brown, during the 1910 trial, located the scenes of Cook's fake pictures. The location of these pictures was found to be only 5,300 feet above sea level and over twenty miles from Mount McKinley.

The first and second expeditions were not successful as far as Mount McKinley was concerned. Yet the account of a failure of this kind is as illuminating and interesting as that of a success and the reader will not be disappointed in the earlier pages of the book which embody the results of the two attempts, as adventure, feats of skill and endurance and thrilling experiences are not lacking.

The 1912 expedition, profiting by the earlier failures, was well equipped to make a last, hard effort. The ascent of the north slope is a particularly interesting story. There were days of hunting before McKinley was reached, a particularly vivid account of an avalanche with a series of five illustrations showing stages of its approach, and the common experiences with crevasses and storms. The party were able to reach 11,000 feet with a dog team, and here was the main camp from which, by a series of stages which lasted altogether twenty-eight days, the work of conquest was pushed. At the end an elevation of about 20,300 feet was reached, the last hard climb was done and only a gentle slope separated them from the coveted goal when the party was forced to turn back on account of a blizzard of unusual intensity. Although the credit for reaching the top of Mount McKinley goes to a later explorer, the credit of the conquest of the peak belongs to the members of the 1912 expedition. The book is a worthy addition to the library of mountaineering, and the artist-author has not only written an interesting story but he has, with his paintings and drawings, illuminated many phases of the experience of the party.

ROBERT M. BROWN.

The Wilderness of the Upper Yukon. A Hunter's Explorations for Wild Sheep in Sub-Arctic Mountains. By Charles Sheldon. xxi and 354 pp. Ills., index. Charles Scribner's Sons, New York, 1911. $3. 9½ x 6½.

This account, in the main a hunter's tale, gives considerable information about the territory north of Skaguay in the Yukon Territory, ranging from the Coast Ranges to the Ogilvie Rockies. The first impression of the book is altogether unfavorable owing to the character of some of the illustrations, which are of no value except as a memento of the killing ability of the author. The text gives a saner idea of the hunting trip. As readable accounts of the area are few in number, this book will be to many a source of information. It must be noted, however, that the author was solely interested in

wild sheep and his aim is merely to give the information from the standpoint of a hunter and a naturalist; but still, by photographs and reports of daily experiences in climbing and camping, a fair appreciation of the topography and the climate of the upper Yukon is gained. ROBERT M. BROWN.

A Motor Tour Through Canada. By Thomas W. Wilby. xviii and 290 pp. Ills., index. John Lane Co., New York, 1914. $1.50. 8 x 5½.

Mr. Wilby gives us the panoramic view of Canada as seen from the tonneau of a motor car on its journey from Halifax to Victoria. In easy style, largely abounding in conversations with persons whom he met on his tour, he relates an agreeable story of his experiences. Among those stand out prominently his impressions of the Northwest Mounted Police and their prisoners. The half-tone reproductions add interest to his tale. DAVID H. BUEL.

CENTRAL AMERICA AND WEST INDIES

La Nouvelle Voie Maritime: Le Canal de Panama. Par Daniel Bellet. 330 pp. Map, ills. Series: Bibliothèque des Amis de la Marine. E. Guilmoto, Paris, 1913. Fr. 5. 8 x 5.

Mr. Bellet's book on the Panama Canal will make its appeal, perhaps, to all except Americans. In it he never loses sight of the fact that the French should be credited with the Canal's first inception, and much space is given to the preliminary French work. A chapter on sanitation gives a very good description, including statistics, of the splendid work of Colonel Gorgas on "cleaning up" the Canal, showing the wonderful decrease in the mortality on the Zone from 47 to 19 per 1,000 in three years.

Even though the Canal be completed, grave difficulties may arise and give constant apprehension, as, for example, the landslides and, even more, the chemical composition of the underlying rocks of the Gatun Dam, which, geologists suggest, may in time become soft through saturation.

The work would be more acceptable if Mr. Bellet had not introduced so much bitterness at the success which the "Yankees" (so called throughout the book) achieved, where the French so woefully failed. A. C. B.

Twentieth Century Jamaica. By H. G. de Lisser. 208 pp. Ills. The Jamaica Times, Ltd., Kingston, 1913. 8 x 5½.

Will Jamaica be absorbed by the United States or Canada or remain the possession of England? Mr. de Lisser considers this problem in detail. He next takes up the history of the island, describes the cities, towns and country; the life of the people, their beliefs, customs, religions, politics, industries and commerce. The book is well worth reading.

WILBUR GREELEY BURROUGHS.

The Southland of North America. By G. P. Putnam. xiv and 425 pp. Map, ills. G. P. Putnam's Sons, New York, 1913. $2.50. 8 x 5½.

A series of entertaining sketches conveying vivid impressions of scenic wonders and easy-going customs. The author shows remarkable comprehension of the Latin-American turn of mind. His comments on the contrasting business methods adopted by Europeans and Americans deserve attention. Of special interest are the accounts of his meetings with his countrymen. The book will be read with especial pleasure by all who have traveled in Central America. LEON DOMINIAN.

SOUTH AMERICA

The South American Tour. By Annie S. Peck. 398 pp. Map, ills., index. George H. Doran Co., New York, 1913. $2.50. 8½ x 5½.

In the years during which the Panama Canal has been nearing completion the South American tour has been coming into its own. Miss Peck's book is designed to help the South American tourist on his way. Railroad and steamship lines are catalogued, the principal hotels and their prices are listed, the points of interest are indicated, and useful historical information

is supplied. The account of the Harvard Observatory, near Arequipa, and its work is noteworthy; also the account of the trip in the new tunnel through the Andes from Argentine to Chile. Director General John Barrett of the Pan American Union writes an appreciative preface. DAVID H. BUEL.

Venezuela. By Leonard V. Dalton. 320 pp. Map, ills., index. T. Fisher Unwin, London, 1912. 9 x 6.

Venezuela is known among us as the land of coffee and asphalt, of Bolivar and Castro, upon the occasion of whose boundary dispute with Great Britain President Cleveland pronounced his strong reassertion of the Monroe Doctrine. In the 241 pages of his book the author of this work gives a clear but brief account of all these matters. The chapters on the history of the country, political, commercial and industrial, are more extended than those dealing with the geography, geology, botany, zoology and ethnology. His account of education in Venezuela is quite brief, perhaps because education itself is not much developed there. The illustrations are good half-tones of the scenery, public buildings and monuments of the country. A map in black and white displays the mountains, rivers, international and state boundaries, the capitals, railroads and roads of Venezuela. The appendices record the figures for population, trade, meteorology, vital statistics, and finance. The bibliography quotes 411 works on Venezuela. The final chapter on the future of the country is timely. DAVID H. BUEL.

AFRICA

The Agricultural and Forest Products of British West Africa. By Gerald C. Dudgeon. Imperial Inst. Handbooks. x and 170 pp. Maps, ills., index. John Murray, London, 1911. 5s. 9 x 5½.

A careful account of the vegetable commercial resources of Gambia, Sierra Leone, Gold Coast, Ashanti, Northern Territories, Northern Nigeria and Southern Nigeria.

The Guide to South and East Africa for the use of Tourists, Sportsmen, Invalids and Settlers. Edited annually by A. Samler Brown and G. Gordon Brown. liv and 695 pp. Maps, ills. Union-Castle Mail SS. Co., Ltd., London, 1913.

This book improves with every issue. An enormous amount of accurate and up-to-date information is made readily accessible by a good index. The most important maps, by George Philip & Son, have the symbolism used by the best map-makers of Germany and are fine specimens of scientific map generalization. For the vast territory covered this book is one of the best reference sources.

Botanical Features of the Algerian Sahara. By William Austin Cannon. vi and 81 pp. Map, ills. Carnegie Inst., Washington, D. C., 1913. $2.50 10 x 7.

The principal object of this entertaining volume is to add to the breadth of the phytogeographic studies now prosecuted at the desert laboratory of the Carnegie Institution. To geographers the great value of these researches is that they serve to establish upon an observational basis the problems of desiccation in their relation to habitability in past epochs. No little study has been devoted of late to the questions of climatic variation in reference to the very extensive remains of former habitation of the greater deserts. Sir Aurel Stein, Sven Hedin and Prof. Ellsworth Huntington have furnished data covering the deserts of inner Asia, Prof. Huntington has proposed a theory of desiccation. Mr. Cannon in this careful paper reads the lesson of the plants and makes plain the significance of the line of equilibrium, of balanced poise between the aeolian waste of sand and the plant growth of the arid region. In the end these two forces tend to establish permanence, but in the episodes there is an unevenness in the action of the forces, the vegetal force being slow and sure to the very limit of its possibility, the aeolian marked by sudden and

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extensive inroads irregularly spaced between periods of quiescence. For the purposes of social geography it is very fortunate that the Algerian region of study is one for which we have not only the material remains of human occupancy but in addition a not inconsiderable written record of historical material. From this fortunate association of phytogeography and a more or less complete record extending over twenty centuries it may be possible for the students of desiccation to establish a time scale by which to measure similar phenomena where the problem must rest most largely on the record of desert vegetation alone.

WILLIAM CHURCHILL.

The Tribes of Northern and Central Kordofán. By H. A. MacMichael. Cambridge Archaeol. and Ethnol. Series. xv and 259 pp. Maps, index. University Press, Cambridge, 1912. G. P. Putnam's Sons, New York. 10s. 6d. 8½ x 5½.

We have here another volume in the Cambridge Ethnological Series in which the influence of Dr. A. C. Haddon is most manifest. This monograph gives us a concise statement of all that is known of the past and present of the wild tribes of the Sudan who came out of their seclusion a few years ago to give their hopeless battle against the European advance upon Africa. As is usual in wars, these men of the Mahdi knew very little of what they were fighting for and still less of why they were beaten. Equally the British had very faint information as to the reason of their fighting, but they carried away a profound respect for the battle abilities of these "first-rate fighting men." This seems to tinge Mr. MacMichael's attitude toward the people of his study. He finds them a good lot of semi-savages and his study is interesting. He has conducted careful researches through the tangle of the history of Kordofan and has done considerable toward evaluating the different narratives. Despite all his efforts the meaning of the name Kordofan is still incomprehensible.

Hausa Folk-Lore, Customs, Proverbs, etc. Collected and Transliterated with English Translation and Notes. By R. Sutherland Rattray. With a preface by R. R. Marett. Vol. 1: xxiv and 326 pp. Vol. 2: 315 pp. Ills. Oxford University Press (Amer. Branch), New York, 1913. $9.25 two vols. 9½ x 6½.

Not only is this material of the utmost value in the study of African folklore but Mr. Rattray has followed a method which should serve as a model for such inquiry. Qualified as an interpreter in the Hausa and in several cognate tongues he has recognized the factor of error which is introduced when the European observer is obliged to collect tales from word of mouth and subjects them to the double chance of error in transcription and translation. Mr. Rattray selected one of the wisest of Hausa and instructed him to write out the manuscripts here reproduced in facsimile. Facing each page is transliteration and translation and thereby the idiom may be literally followed and the possibility of wrong interpretation reduced to the minimum.

We seem in this work to have opened a new pool of African tales, for several motives are introduced which are not found in the great mass of African animal stories. Here we have several instances of the story based on name-magic, a motive which still exists in our child lore but derived from an entirely different source. Here is a sample: The good but scorned wife finds a spoon. Its name is Help-me-that-I-may-taste and every time she calls the spoon by name her calabash is filled with food. The wicked wife becomes envious; she goes out and finds a switch. Its name is Whack-me-that-I-may-feel, she gets a sound beating, and virtue triumphs. In several tales we find the wise and mischievous spider playing tricks upon the other animals, and through the Sierra Leone stories we are able to establish the association of the sage spider with the great body of Brer Rabbit myth which is spread so extensively through Africa.

WILLIAM CHURCHILL.

South Africa. Seven Lectures. Prepared for the Visual Instruction Committee of the Colonial Office by A. J. Sargent. Visual Instruction Comm. Handbooks, No. 5. 120 pp. Maps, ills. G. Philip & Son, Ltd., London, 1914. 8d. 7½ x 5½.

Contains outlines of a course of seven lectures on South Africa including

all the British territory; with references to the lantern views prepared for the lectures. The book treats soundly of the geography, resources and development of South Africa and is a dependable source of reference.

African Missions. Impressions of the South, East, and Centre of the Dark Continent. By Benjamin Garniss O'Rorke. With a preface by The Right Rev. J. Taylor Smith. viii and 213 pp. Map, ills., index. Soc. for Promoting Christian Knowledge, London, 1912. 3s. 6d. 8 x 5.

An excellent, accurate account of some of the leading missionaries of Africa and of their effective participation in the beginnings of the modern development of the continent.

ASIA

Syria, the Land of Lebanon. By Lewis G. Leary. 225 pp. Ills., index. McBride, Nast & Co., New York, 1913. $3. 9½ x 6½.

This charming little volume is all the more interesting because it is replete with the personal enthusiasms of the writer. In his preface he observes that in the company of his earlier work on Palestine this volume may furnish a complete view of the lands of the Bible. This is true only in a literary and artistic sense, for there is nothing which smacks of the handbook to the Scriptures. In his method of treatment the Sacred Canon is but the earliest and most familiar literature of the subject; its imagery and its phrases come into mind when we approach the scenes with which for ages they have been associated, the cedars of the Lord, the cedars of Lebanon, the figures which hang like fringes on Hermon dominating the distant prospect. The Syria of the present has a warm and happy appeal to the author, he glories in the Syria of the lengthening past surrounding Damascus, oldest of the cities of men, alive to-day as alive in the dawn. He is always seeing the brave procession, Saladin and Richard but yesterday, the sweep of the crescent, the march of legions to overthrow Zenobia in Tadmor of the desert, the combat of St. George, the coming of the cross, the hosts of the Egyptians under conquering Pharaoh, the Hittites, the beginning of time. WILLIAM CHURCHILL.

Trans Himalaya. Discoveries and Adventures in Tibet. By Sven Hedin. Vol. 3. xv and 426 pp. Maps, ills., index. The Macmillan Co., New York, 1913. $4.50. 9 x 6.

An interval of three years separates the appearance of Hedin's third volume from the other two. In this last volume he fills in some of the gaps in his earlier narrative and brings his last journey in Tibet to an end. He also takes occasion to answer various criticisms aroused by his earlier work. Most of the volume consists of a description of a journey from the sources of the Indus to Ladak and of his final excursion from Lake Nganglaring via Lake Manasarowar to Simla. He gives the details of each day with great minuteness. No special adventures mark these journeys and therefore the space is given to vivid descriptions of scenery and of Buddhist lamaseries.

In three places Hedin breaks the thread of his journey to insert a series of chapters of a somewhat controversial nature. In the first series he gives an historical account of all that was known of the Trans-Himalayas previous to his journey. He shows that although mountains beyond the Indus and Brahmaputra are frequently referred to, the world had not realized their existence as a separate entity. It is truly remarkable, as he says, that one of the world's greatest mountain ranges should have remained almost unknown until after the discovery of the poles.

The second interruption deals with the lakes of Manasarowar and Lanak-tso, or Rakas-tal. Formerly four rivers, the Brahmaputra, Ganges, Sutlej and Indus were supposed to flow from the holy lake of Manasarowar. It has been a long process to discover that the Sutlej alone flows from it, and that much of the time even this receives no water. The two lakes together form a very delicate rain-gage, for Manasarowar overflows to Lanak-tso at fairly frequent intervals, while Lanak-tso overflows to the Sutlej only at periods a

century or two apart. Unfortunately the records are incomplete and inexact. This condition of the lakes naturally leads to the problem of changes of climate, but Hedin says little about it except to remark that "it seems as though the climate in the present period is tending toward greater dryness." This agrees with his earlier conclusions, but in the interim he has been strongly of the other opinion.

The third interruption in the narrative deals with Lamaism and Catholicism, and has no special geographical bearing.

Perhaps the strongest impression left by the book is the remarkable contrast between the broad, undissected highlands of the great plateau and the tremendously dissected border region where the rivers break through the Himalayas and have cut enormous gorges. In reading this book, as in reading all the others by the same author, one cannot but admire Hedin's remarkable capacity for travel in difficult places and his power of vividly describing his experiences. ELLSWORTH HUNTINGTON.

La Pluie en Chine durant une Période de Onze Années 1900-1910. Par Louis Froc. Première partie: Les Observations. 1912. 62 pp. Diagrams. Observatoirè de Zi-Ka-Wei, Appendice au *Bull. Météorol. de 1910*. Shanghai. 12 x 10.

In 1896, Supan gave us a very careful study of the rainfall of China. Since then, observations have been accumulating which throw further light on this subject, although, of course, stations are still few in number, and mostly near the coast. Father Louis Froc, S.J., Director of the Zi-Ka-Wei Observatory, whose excellent work on meteorology is well known, has now collected and summarized the available rainfall records for a homogeneous period of eleven years for thirty-four stations, and for some forty other stations with shorter and broken records. Not only are the annual and monthly means considered, but the number of rainy days, the amount of rainfall on a rainy day, etc. Curves showing the annual variation of rainfall and the seasonal means are also given. For those who are studying Chinese climate this publication will prove indispensable. R. DEC. WARD.

Au Yunnan et dans le Massif du Kin-Ho (Fleuve d'Or.) Par A F. Legendre. xii and 433 pp. Map, ills. Plon-Nourrit et Cie, Paris, 1913. 8 x 5½.

This is the third volume of the reports of Dr. Legendre upon the results of his years of study of the life of the Chinese of the far west, the preceding volumes having dealt with Sechuan and Kien-chang and the lands of the Lolo. This later expedition met with the misfortune of the recent upheaval of the Middle Kingdom, for at Hwang Chuitang Dr. Legendre was attacked by revolutionaries and, with his compánion, Dessirier, received many severe wounds. His escort took to its heels and the two Frenchmen owed their lives to the fact that the marauders preferred to lose no time in looting the caravan. The terrain covered in this close exploration lies between Yunnan Sen and Yatcheou, between 25° and 30° N., and never far away from the meridian of 100° E. Herein is embraced a considerable area of the agricultural valleys of the Tong Ho, the Ya Long and Ngan Ning, and the southerly bend of the Yang-tse-kiang near the point where it receives the waters of these two streams just below their confluence. Much of this is newly opened territory and none of it has received before such close study in topographical detail. The leader, as soon as his wounds permitted, succeeded in recovering no inconsiderable part of his collections and two of his record books of Yunnan; unfortunately the day books of the unknown country were not recovered and this report, so far as it deals with its most valuable material, has had to be written from memory. WILLIAM CHURCHILL.

Missionary Joys in Japan; or, Leaves from my Journal. By Paget Wilkes. With an introduction by the Rev. B. F. Buxton. xvi and 321 pp. Ills. Morgan & Scott, Ltd., London, 1913. 7s. 6d. 9 x 6.

There is very little of Japan in this record of fifteen years spent in mission

service. Yet here we have a wealth of topical material of great interest and value. Each chapter, for example, is prefaced by a green sheet reproducing in Japanese script and in translation one of the Japanese formal poems; they have no pertinence to the author's text, their purpose is purely decorative, yet they are worth the space given them. Their classic poise of thought is in strange contrast with the English text which they accompany.

The Evolution of New Japan. By Joseph H. Longford. Cambridge Manuals of Science and Literature. 166 pp. Map, ills., index. G. P. Putnam's Sons, New York, 1913. 1s. 7½ x 5.

Professor Longford's little volume is of the primer type, much information compressed into a shilling's worth of room and all debatable points set forth in positive statement after the manner of such publication. It will serve excellently as the introduction which may guide the beginner toward more extended study of the island empire. The author has had years of consular experience in Nagasaki and therefore is in a position to speak with authority superior to that of many writers. We might wish that he had not gone somewhat out of his way, in recording the end of the Russian war, to note that the peace was signed at Portsmouth, "New Jersey, U. S. A."; probably every child in school knows that our Portsmouth was named after the English Portsmouth and that they are in New Hampshire and Hampshire respectively. Surely no American book could issue from the press of any American university with such a statement as that Portsmouth is in Yorkshire, England.

The Island Dependencies of Japan. An account of the islands that have passed under Japanese control since the Restoration, 1867-1912. A series of monographs, reprinted from the *Imperial and Asiatic Quarterly Review,*" with additions from native sources, translations and new information. By Charlotte M. Salwey. ix and 147 pp. Maps, ills. E. L. Morice, London, 1913. 5s. 9½ x 6½.

The author is an admirer of things Japanese, but in her theme we are not asked to discount her enthusiasms. It is when the culture of Japan is brought into contrast with European cultures that the difficulty of shrewd interpretation arises. In the present theme we find Japan brought into cultural contrast with peoples markedly inferior. Everything that Japan has done for its island dependencies has been a work for betterment, an amelioration of the conditions of the savage. With this foreknowledge we must welcome the praise which the author bestows upon this really great work in desert places, for we know that the praise is deserved beyond any cavil. In six chapters she deals somewhat exhaustively with Japan as the civilizing agent of her island dependencies, Formosa, the Riu-Kiu, the Bonins, the Kuriles, Sakhalin, and the Pescadores with minor islets. It is only recently that we passed under review a Japanese report on the control of the Formosa aborigines; the chapter in this book is of wider scope but it is simply confirmatory of the excellent effect which was produced by the official report upon its single theme. In her chapter upon southern Sakhalin, Mrs. Salwey suggests a topic which must in future attract much greater attention from geographers and ethnographers. In cementing its power upon this region, which appeals to the Japanese nation as essentially an integer in the island empire, the government has sent its geodesists into the north; and with settlement, which is now being stimulated in order to relieve the overcrowding in the northern islands, we may expect soon to have valuable reports from the scientific men of Japan.

WILLIAM CHURCHILL.

Village Life in Korea. By J. Robert Moose. 242 pp. Ills. Smith & Lamar, Nashville, Tenn. $1. 8 x 5½.,

The author gives us a valuable village record, the story of a race which has undergone for many centuries a singularly secluded development, wholly unreceptive toward any influence from outside and growing into a marked

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accentuation of a stationary type. His eye has shown itself alert for all the little things of life which count for so much in the differences of one community from another; these he has set down with such simplicitiy that we gain the impression that his record has largely increased our acquaintance with the Koreans in their daily life. WILLIAM CHURCHILL.

OTHER BOOKS RECEIVED

These notes do not preclude more extended reference later

NORTH AMERICA

THE CHANNEL ISLANDS OF CALIFORNIA. A book for the angler, sportsman, and tourist. By C. F. Holder. 2nd edit. xvi and 397 pp. Ills., index. A. C. McClurg & Co., Chicago, 1910. $2. 8½ x 5½.

DOCUMENTARY HISTORY OF DUNMORE'S WAR, 1774. Compiled from the Draper Manuscripts. Edited by R. G. Thwaites and L. P. Kellogg. xxviii and 472 pp. Ills., index. Wisconsin Hist. Soc., Madison, 1912. $2. 7½ x 5½.

THE DOMINION OF CANADA. By W. L. Griffith. x and 450 pp. Map, ills., index. Little, Brown & Co., Boston, 1913. $3. 8½ x 6.

THE EXPEDITION OF THE DONNER PARTY AND ITS TRAGIC FATE. By E. P. Donner Houghton. xxi and 375 pp. A. C. McClurg & Co., Chicago, 1911. $1.70. 8½ x 5½.

FIFTEEN THOUSAND MILES BY STAGE. A woman's unique experience during thirty years of path finding and pioneering from the Missouri to the Pacific and from Alaska to Mexico. By C. A. Strahorn. xxv and 673 pp. Ills. G. P. Putnam's Sons, New York, 1911. $4. 9 x 6½.

THE FISHES OF THE PACIFIC COAST. A handbook for sportsmen and tourists. By C. F. Holder. 122 pp. Ills. Dodge Publishing Co., New York, 1912. 50 cents. 8 x 5.

FRONTIER DEFENSE ON THE UPPER OHIO, 1777-78. Compiled from the Draper Manuscripts. Edited by R. G. Thwaites and L. P. Kellogg. xvii and 329 pp. Map, ills., index. Wisconsin Hist. Soc., Madison, 1912. $2. 7½ x 5½.

THE INDIANS OF TO-DAY. By G. B. Grinnell. Revised edit. 426 pp. Ills., index. Duffield & Co., New York, 1911. $2. 8 x 5½.

LEWIS EVANS: His Map of the Middle British Colonies in America. A comparative account of ten different editions published between 1755 and 1807. By H. N. Stevens. 41 pp. H. Stevens, Sons & Stiles, London, 1905. 5s. 9 x 6.

LOUISIANA UNDER THE RULE OF SPAIN, FRANCE AND THE UNITED STATES, 1785-1807. Social, Economic, and Political Conditions of the Territory represented in the Louisiana Purchase as portrayed in hitherto unpublished contemporary accounts by Dr. Paul Alliot and various Spanish, French, English, and American Officials. Translated or transcribed from the original manuscripts. Edited by J. A. Robertson. Vol. 1: 376 pp. Vol. 2: 391 pp. Maps, index. A. H. Clark Co., Cleveland, O., 1911. $10. 9½ x 6½.

THE MOUND BUILDERS; being an account of a remarkable people that once inhabited the valleys of the Ohio and Mississippi, together with an investigation into the archæology of Butler County, O. By J. P. MacLean. 7th edit. 231 pp. Ills. Robert Clarke Co., Cincinnati, 1904. $1.50.

NOVA SCOTIA: The Province That Has Been Passed By. By B. Wilson. Revised edit. xii and 258 pp. Ills. Constable & Co., London, 1913. 5s. 8½ x 5½.

THE OREGON TRAIL: SKETCHES OF PRAIRIE AND ROCKY-MOUNTAIN LIFE. By F. Parkman. 4th edit. xi and 479 pp. Index. Little, Brown & Co., Boston, 1911. $2. 8½ x 5½.

REMINISCENCES OF THE YUKON. By the Hon. Stratford Tollemache. xi and 316 pp. Ills., index. E. Arnold, London, 1912. 12s. 6d. 9 x 6.

THE REVOLUTION ON THE UPPER OHIO, 1775-77. Compiled from the Draper Manuscripts. Edited by R. G. Thwaites and L. P. Kellogg. xix and 275 pp. Map, ills., index. Wisconsin Hist. Soc., Madison, 1908. 7½ x 5½.

THE STORY OF SLATE AND THE SLATE INDUSTRY. By G. Bleekman. 93 pp. Ills. Capital City News Syndicate, Harrisburg, Pa., 1911. $1. 6 x 9.

THE SUBWAYS AND TUNNELS OF NEW YORK. Methods and Costs. With an appendix on tunneling machinery and methods and tables of engineering data. By G. H. Gilbert, L. I. Wightman and W. L. Saunders. xiv and 372 pp. Ills., index. J. Wiley & Sons, New York, 1912. $4. 9½ x 6½.

TRAVELS IN THE CONFEDERATION [1783-1784]. New Jersey, Pennsylvania, Maryland, Virginia, the Carolinas, East Florida, the Bahamas. From the German of Johann David Schoepf. Translated and edited by A. J. Morrison. Part 1: x and 426 pp. Part 2: 344 pp. Indexes. W. J. Campbell, Philadelphia, 1911. $6. 8½ x 5½.

THE WONDERS OF THE COLORADO DESERT (SOUTHERN CALIFORNIA). Its rivers and its mountains, its canyons and its springs, its life and history, pictured and described. Including an account of a recent journey made down the overflow of the Colorado River to the mysterious Salton Sea. By G. W. James. xix and 547 pp. Map, ills., index. Little, Brown & Co., Boston, 1911. $2.50. 9 x 6.

ASIA

THE FALL OF THE MOGUL EMPIRE. By S. J. Owen. xii and 271 pp. Map, index. J. Murray, London, 1912. 7s. 6d. 9 x 6.

THE INTERNATIONAL RELATIONS OF THE CHINESE EMPIRE. The Period of Conflict 1834-1860. By H. B. Morse. xxxix and 727 pp. Maps, ills., index. Longmans, Green & Co., N. Y., 1910.

JAPAN OF THE JAPANESE. By J. H. Longford. x and 314 pp. Map, ills., index. Charles Scribner's Sons, New York, 1913. $1.50. 7½ x 5½.

THE JAPANESE IN MANCHURIA, 1904. By E. L. V. Cordonnier. Translated by C. F. Atkinson. Vol. 1: The Yalu and Te-Li-Ssu. xi and 281 pp. Maps. H. Rees, London, 1912. 7s. 6d. 8½ x 5½.

SIAM: A Handbook of Practical, Commercial, and Political Information. By W. A. Graham. 2nd edit. Map, ills., index. A. Moring, London, 1912. 10s. 6d. 7½ x 5.

SIXTY YEARS: LIFE AND ADVENTURE IN THE FAR EAST. By J. D. Ross. 2nd edit. Vol. 1: xv and 364 pp. Vol. 2: xi and 411 pp. Map, ills. Hutchinson & Co., London, 1912. £1 4s. 9 x 6.

BIG-GAME SHOOTING IN UPPER BURMA. By Major G. P. Evans. 240 pp. Map, ills., index. Longmans, Green & Co., N. Y., 1911. 7s. 6d. 9 x 6.

THE PACIFICATION OF BURMA. By Sir Charles Crosthwaite. xii and 355 pp. Maps, ills., index. E. Arnold, London, 1912. 16s. 9 x 6.

CAMPAIGNS ON THE NORTH-WEST FRONTIER. H. L. Nevill. xix and 413 pp. Maps, ills., index. J. Murray, London, 1912. 15s. 9 x 6.

THE HISTORY OF CASTE IN INDIA. Evidence of the laws of Manu on the social conditions in India during the Third Century A. D., interpreted and examined; with an appendix on radical defects of ethnology. By Shridhar V. Kethar. Vol. 1: xv and 192 pp. Index. Taylor & Carpenter, Ithaca, N. Y., 1909. $1.50. 8 x 5½.

INDIAN PAGES AND PICTURES. Rajputana, Sikkim, the Punjab, and Kashmir. By M. M. Shoemaker. xxii and 475 pp. Ills., index. G. P. Putnam's Sons, N. Y., 1912. $2.50. 8 x 6.

INDIA AND TIBET. A history of the relations which have subsisted between the two countries from the time of Warren Hastings to 1910; with a particular account of the mission to Lhasa of 1904. By Sir Francis Younghusband. xvi and 455 pp. Maps, ills., index. J. Murray, London, 1910. £1, 1s. 9 x 6.

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PHYTOGEOGRAPHY AND ZOOGEOGRAPHY

THE ANIMAL WORLD. By F. W. Gamble. Home Univ. Library. xii and 256 pp. Ills., index. Henry Holt & Co., New York, 1911. 50 cents. 7 x 5.

DIE LEITENDEN GESICHTSPUNKTE EINER ALLGEMEINEN PFLANZENGEOGRAPHIE IN KURZER DARSTELLUNG. Von H. Grafen zu Solms-Laubach. ix and 243 pp. Index. A. Felix, Leipzig, 1905. 9½ x 6.

GRUNDZÜGE EINER ALLGEMEINEN PFLANZENGEOGRAPHIE. Von Joakim Frederik Schouw. Aus dem Dänischen übersetzt vom Verfasser. viii and 524 pp. G. Reimer, Berlin, 1823. 8 x 5.

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NEW MAPS

EDITED BY THE ASSISTANT EDITOR

For system of listing maps see p. 74 of this volume

MAPS ISSUED BY UNITED STATES GOVERNMENT BUREAUS

U. S. GEOLOGICAL SURVEY

Topographic Sheets

(Including Combined and Special Topographic Maps)

California. (a) Holt Quadrangle. Surveyed in 1911. 1:31,680. 38°0′0″ - 37°52′30″ N.; 121°30′0″ - 121°22′30″ W. Contour interval 5 ft. Edition of Dec. 1913.

(b) Marysville Buttes and Vicinity. Surveyed in 1905 and 1909-1911. 1:62,500. 39°20′ - 39°5′ N.; 121°55′ - 121°40′ W. Interval 25 ft. Edit. of Nov. 1913.

(c) Stockton Quad. Surveyed in 1911. 1:31,680. 38°0′0″ - 37°52′30″ N.; 121°22′30″ - 121°15′30″ W. Interval 5 ft. Edit. of Dec. 1913.

(d) Woodward Island Quad. Surveyed in 1911. 38°0′0″ - 37°52′30″ N.; 121°37′30″ - 121°30′0″ W. Interval 5 ft. Edit. of Nov. 1913.

[Maps (a), (c) and (d) are three adjoining sheets of the two-inches-to-the-mile map of the San Joaquin-Sacramento Valley. Valuable representation of the built-up area in the city of Stockton on map (c). Map (b) is reduced from 9 sheets on the scale of 1:31,680; it is a special map whose boundaries do not coincide with those of the regular 1:62,500 sheet. As there are two other topographic sheets with a similar title it may be helpful to call attention to them: the first is the 1:31,680 sheet entitled Marysville Buttes Quadrangle, listed under "California (c)" in the *Bull.*, Vol. 45, 1913, p. 475; the second is an old 1:125,000 sheet entitled Marysville Sheet, surveyed in 1886. The present 1:62,500 sheet is the first one adequately to represent the relief of the buttes, as on the 1:31,680 sheet the contour interval changes from 5 to 500 ft. above an elevation of 300 ft.]

Idaho. Slug Creek Quad. Surveyed in 1910-1911. 1:62,500. 42°45′ - 42°30′ N.; 111°30′ - 111°15′ W. Interval 50 ft. Edit. of Dec. 1913.

Illinois. Sumner Quad.* Surveyed in 1911. 1:62,500. 38°45′ - 38°30′ N.; 88°0′ - 87°45′ W. Interval 20 ft. Edit. of Nov. 1913.

Maryland. Nanjemoy Quad.* Surveyed in 1911. 1:62,500. 38°30′ - 38°20′ N.; 77°20′ - 77°0′ W. Interval 20 ft. Edit. of Nov. 1913.

[Coextensive with the northeast corner of the old Fredericksburg, Va.-Md., sheet, 1:125,000, surveyed in 1887-88. It adjoins to the south the Indian Head sheet listed under Maryland in the February *Bull.* (Vol. 46, 1914), p. 155, and, like it, does not show topography for the Virginia portion of the sheet.]

New Mexico Alum Mountain Quad. Surveyed in 1910-1911. 1:125,000. 33°30′ - 33°0′ N.; 108°30′ - 108°0′ W. Interval 100 ft. Edit. of Dec. 1913.

New York. Lyon Mountain Quad.* Surveyed in 1911. 1:62,500. 44°45′ - 44°30′ N.; 74°0′ - 73°45′ W. Interval 20 ft. Edit. of Dec. 1913.

Ohio. Sidney Quad.* Surveyed in 1911. 1:62,500. 40°30′ - 40°15′ N.; 84°15′ - 84°0′ W. Interval 10 ft. Edit. of Nov. 1913.

Ohio–West Virginia. Surveyed in 1900-1901. 1:62,500. 38°30′ - 38°15′ N.; 82°45′ - 82°30′ W. Interval 20 ft. Preliminary edit., Nov. 1913.

[Coextensive with the northeastern quarter of the Kenova, Ky.-W.Va.-O., 1:125,000 sheet. The western two-thirds, however, comprising Kentucky territory, are blank.]

* On these sheets woods are shown in green.

XUM

Pennsylvania. Mercer Quad.* Surveyed in 1911. 1:62,500. 41°15′ - 41°0′ N.; 80°15′ - 80°0′ W. Interval 20 ft. Edit. of Nov. 1913.

Tennessee. Hollow Springs Quad.* Surveyed in 1911. 1:62,500. 35°45′ - 35°30′ N.; 86°15′ - 86°0′ W. Interval 20 ft. Edit. of Dec. 1913.

[An excellent illustration of the fact that the contour method does not *per se* convey relative impressions of altitude. At first sight the sheet seems to represent a plain bordered by a higher mountain area to the west: only on closer inspection of the contour elevations and the drainage does it appear that the plain is a plateau and the mountain area its western dissected margin (incidentally the western border of the Appalachian Plateau).]

United States. [Contour Map of the] United States. 1:2,500,000. 52° - 24° N.; 129° - 65° W. 2 colors. With inset: Alaska. [1:11,000,000]. 1 color. In 9 sheets. U. S. Geological Survey, Washington, D. C., 1913.

[The publication, in a new edition, of this standard contour map of the United States is an event of importance. The last previous edition was published in 1898, although editions of the same map, without the important element of relief, however, have appeared recently. The only recent general maps of the United States with relief published by the Survey have been the contour and the hypsometric map, 1:7,000,000 (see *Bull.*, Vol. 44, 1912, p. 399, under "United States," b and c) which are not comparable with the present map, however, because of their much smaller scale. The extent of new surveys made in the fifteen years since the publication of the previous edition has led to a redrawing of the contours over practically all of the map, as a comparison with the 1898 edition will show: even such older portions of the country as New York and Pennsylvania are affected. Up to 2,000 ft. the contour interval is 500 ft. (except that the 100 ft. contour is shown); above that elevation, 1,000 ft. The fact that the contours are drawn more delicately than on the previous edition makes for greater plasticity on the whole. Thus the Sierra Nevada stands out much better. The omission of color on the water surfaces is a slight disadvantage, probably justified, however, by the decreased cost due to the elimination of one color plate. The publication of the map in 9 instead of 3 sheets, as previously, makes it much easier to consult. As before, the map shows, in black, county boundaries and names, towns and railroads. While this map is unquestionably the best general map of the United States at present published by a government bureau (the General Land Office map is about the only other to come into consideration) it may be questioned whether the contour method is the best to represent relief on a general map. While fully recognizing its appropriateness for a detailed survey the reviewer's opinion is that hachuring renders relief far more adequately on a general map. Good examples are the admirable map of the United States in Vivien de St. Martin and Schrader's Atlas Universel de Géographie, 1:5,000,000 (Hachette et Cie., Paris, 1908) and the map on the same scale in Andree's Handatlas (5th edit., Velhagen und Klasing, Leipzig, 1906). That this view has been held by others is attested by the various maps published during the classic period of exploration by the Army engineers, notably Lieut. G. K. Warren's map of the western United States, 1:3,000,000.]

NORTH AMERICA

Canada

Canada, etc. (a) Canada: Orographical Features and Railways. 1:17,000,000. 75° - 40° N.; 158° - 35° W. 8 colors.

(b) Canada: Economic Development. 1:17,000,000. 75° - 40° N.; 158° - 35° W. 8 colors.

(c) North American Colonies, 1755-1763. [1:18,000,000]. 64° - 36° N.; 100° - 50° W. 5 colors.

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* On these sheets woods are shown in green.

(d) British North America, 1791. [1:18,000,000]. 59° - 40° N.; 100° - 50° W. 4 colors.

(e) Canada: Density of Population. [1:23,000,000]. 68° - 40° N.; 145° - 50° W. 6 colors.

Accompany "The Dominion of Canada: A Study in Regional Geography" by A. S. White, *Scottish Geogr. Mag.*, Vol. 29, 1913, pp. 524-547 and 565-580, as follows: maps (a) and (b) facing p. 564, map (c) facing p. 526, map (d) facing p. 528, and map (e) facing p. 576.

[Map (a) a helpful hypsometrical map (six tints) showing the main transcontinental railroads in red and accompanied by a profile across the country. Map (b) is a suggestive economic map differentiating between (1) industrial districts, (2) present agricultural lands, (3) lands likely to be opened up for agriculture in the near future, (4) present grazing lands, (5) present forest lands and (6) fisheries, and also showing the occurrence of gold, silver, coal and iron. Maps (c) and (d) are historical maps offering nothing new. Map (e), besides distinguishing between five population density grades, shows the territory settled since 1901. It brings out well that practically only the southern margin of Canada is settled.]

United States

United States. United States West of the Mississippi River, Mexico and Part of the Dominion of Canada and Central America. Compiled under the direction of the Southern Pacific Company and corrected to June 30, 1909. 1:1,267,200. 57⅔° - 13½° N.; 132° - 78° (in middle of right border 85°) W. Copyrighted, 1910, by Southern Pacific Co. Photo. Lith. Britton & Rey, S[an] F[rancisco]. In 18 sheets. [Gift from Wm. Hood, Chief Engineer, So. Pac. Co.]

[A valuable map on a relatively large scale showing exhaustively all the railroads existing at the time of publication within the territory represented. This extends from Portland Canal, Reindeer Lake and James Bay on the north to Salvador on the south and from the Pacific on the west to James Bay, Indiana, Alabama, and British Honduras on the east. The large scale of the map is brought out by its size, which is about 13 by 9 feet. Such a map is especially valuable because of the relative inaccessibility of the material which it presents, as those who have sought detailed authentic information as to the routes of American railroads will realize. Where no topographic sheets exist or where these are out of date the only recourse one has is to the state maps published by the General Land Office, or the post route maps published by the Post Office Department, or again to the maps published by the state railroad commissions. But some of these are not very carefully drawn, others, such as the Post Office maps, are rather expensive, and all of them do not present a consecutive picture of a large part of the country. The present map fulfills this need, a need which the engineering departments of the large railroad systems have felt and thus satisfied. The routes of all lines are shown accurately with all curves, and every station is indicated. Otherwise the map shows the locational element only—rivers, towns, county and state boundaries—except for part of Mexico where relief is shown very effectively in black hachuring, generalized from the topographic sheets, so far as published, of the Comisión Geografico-Exploradora.]

ASIA

Turkey in Asia-Persia. Aufnahmen in Armenien und Kurdistan von Oberleutnant Graf von Westarp, 1912. 1:500,000. [In three parts:] I. Ersindjan-Mamachatun. 39°55′ - 39°10′ N.; 39°10′ - 40°30′ E. 2 colors. II. Erserum-Musch. 40°0′ - 38°43′ N.; 41°0′ - 41°25′ E. 2 colors. III. Bitlis-Urmia-Täbris. 38°45′ - 37°15′ N.; 42°0′ - 46°25′ E. 3 colors. With inset: Übersicht zu Graf Westarps Aufnahmen in Armenien und Kurdistan. 1:15,000,000. 44° - 33° N.; 30° - 52° E. 3 colors. Accompanies, as Taf. 48, "Routenaufnahmen in Armenien und Kurdistan" by von Westarp, *Petermanns Mitt.*, Vol. 59, II, 1913, Dec., pp. 297-300.

XUM

Turkey in Asia. Der Hauptteil des Vulkangebietes von Kula (Lydien), der Katakekaumene der Alten. Nach topographischen und geologischen Aufnahmen im Jahre 1901 von Alfred Philippson. 1:50,000. 38°39′ - 38°31′ N.; 28°30.1′ - 28°47.1′ E. 12 colors. With two insets: (1) Lageplan des Vulkangebietes von Kula. 1:500,000. 38°45′ - 38°17′ N.; 28°10′ - 28°50′ N. 3 colors. (2) Übersicht der Lage von Kula. 1:5,000,000. 41⅔° - 37½° N.; 23° - 30° E. 3 colors. Accompanies, as Taf. 40, "Das Vulkangebiet von Kula in Lydien, die Katakekaumene der Alten" by A. Philippson, *Petermanns Mitt.*, Vol. 59, II, 1913, Nov., pp. 237-241.

[Detailed geological map of a recent volcanic (*katakekaumene* sc. *gê*=burned land) region in the upper Hermos valley which Prof. Philippson investigated in the course of his exploration of western Asia Minor (see under "Asia Minor," *Bull.*, Vol. 43, 1911, pp. 548-549). The detailed description of this region will appear in the forthcoming fourth number of his "Reisen und Forschungen im westlichen Kleinasien."]

EUROPE

Russia. Map of European Russia. Originally compiled by Prof. E. J. Petri; second revised edition prepared under the editorship of J. M. Schokalsky. 1909. 1:2,000,000. 72° - 36° N.; 10° - 77° E. 5-12 colors. With 9 insets: (1) Hypsometrical Map of European Russia. 1:20,000,000. 16 colors. On Plate 15 (see below). (2) Agriculture, Industries and Mineral Resources of European Russia. 1:20,000,000. 17 colors. On Plate 23. (3) Density of Population of European Russia. 1:18,000,000. 13 colors. (4) Southern Coast of Crimea. 1:1,000,000. 8 colors. (5) Density of Population of the Russian Empire. 1:25,000,000. 17 colors. All three on Plate 27. (6) St. Petersburg and Environs. 1:250,000. 9 colors. (7) Moscow and Environs. 1:250,000. 7 colors. Both on Plate 28. (8) Part of the Eastern Coast of the Black Sea. 1:1,000,000. 6 colors. (9) Baku and Environs. 1:500,000. 6 colors. Both on Plate 29. In 16 sheets, constituting Plates 15 to 30 of A. F. Marks's New Reference Atlas, St. Petersburg, 1909. [In Russian.] [Gift from Gen. J. M. Schokalsky.]

[An excellent general map of European Russia on a relatively large scale. The atlas of which these 16 sheets form a part is a Russian edition of Debes's Neuer Handatlas, printed in Germany with Russian nomenclature. These 16 sheets, however, are engraved and printed in St. Petersburg; in execution they almost approach in excellence the admirable German sheets of the atlas. Relief is in brown hachuring, water features in various shades of blue, bathymetric coloring being used on the sheets including portions of the sea. Railroads are in red, making for great legibility. Several kinds of roads are shown, and there is a great number of symbols distinguishing between various types of boundaries, the seats of various administrative authorities, etc. Each sheet has an index on the reverse showing the arrangement of the whole map. For the person familiar with Russian this is the best detailed general map of the country to consult; those unfamiliar with the language must still rely on the second best map of the same type, the 6-sheet map of Russia on the scale of 1:3,700,000, forming Plates Nos. 44 to 49 of Stielers' Hand-Atlas (9th edit., Perthes, Gotha, 1905).]

Scotland. Plant Ecology of Ben Armine District. [1:21,500]. [58°12′ N. and 4°12′ W.] 11 colors. Accompanies "The Plant Ecology of Ben Armine (Sutherlandshire)" (first part) by C. B. Crampton, *Scottish Geogr. Mag.*, Vol. 29, 1913, No. 4, pp. 169-192.

[Detailed study of a peak in the highlands: eight plant formations and the critical elements of the physical geography of the district are shown.]

POLAR

Antarctic. (a) Preliminary Map Showing Sphere of Action of British Antarctic Expedition, 1910-13. [1:6,000,000]. 70° - 90° S.; 140° E. - 140° W. With inset of Antarctic regions, [1:90,000,000].

(b) Track Chart of Main Southern Journey, British Antarctic Expedition, 1910-13. [1:4,000,000]. 77° - 90° S.; 140° E. - 110° W.

(c) Map of the Region Traversed on the Western Journeys, 1911 and 1912. From surveys by Griffith Taylor, B.Sc., B.E., B.A., F.G.S., Frank Debenham, B.A., B.Sc., & Charles Wright, B.A. [1:362,000]. 76°46′ - 78°30′ S.; 160°10′ - 166°0′ E. 2 colors.

(d) Sketch Map to Illustrate Journeys of the Western Geological Parties. [1:1,450,000]. [76¾° - 78½° S.; 160° - 170° E.]

(e) Sketch Map of McMurdo Sound. [1:420,000]. 77°23′ - 78°6′ S.; 163°20′ - 169°10′ E.

(f) [Ross Island showing] Track of Journey from Cape Evans to Cape Crozier, June 27th to August 1st, 1911. [1:460,000]. [77½° S. and 168° E.].

(g) Sketch Map of Mount Erebus showing routes of ascent, from plane table map by F. Debenham. [1:170,000]. [77°30′ S. and 167°15′ E.].

(h) Map to Show the Northern Party's Travels. [1:4,230,000]. 70° - 78° S.; 160° - 175° E. With two insets: (1) [Robertson Bay]. [1:800,000]. [71½° S. and 170° E.]. (2) [Terra Nova Bay]. [1:800,000]. [74½° S. and 164° E.].

(i) Tracks of the "Terra Nova," 1910-11, 1911-12, 1912-13. [1:9,600,000]. 60° - 80° S.; 150° E. - 150° W.

(j) Tracks of S. Y. "Terra Nova," January to March, 1912. [1:2,650,000]. 74° - 78° S.; 162° - 171° E.

Accompany "Scott's Last Expedition," 2 vols., New York, 1913, as follows: map (a), Vol. II, facing p. 346; (b), Vol. I, facing p. 418; (c), Vol. II, facing p. 198; (d), Vol. II, facing p. 190; (e), Vol. I, facing p. 80; (f), Vol. II, facing p. 50; (g), Vol. II, facing p. 244; (h), Vol. II, facing p. 122; (i), Vol. II, facing p. 278; (j), Vol. II, facing p. 274.

[Maps (a) and (b) are general maps showing the topography respectively between Cape Adare and the South Pole and Ross Island and the South Pole; relief is in hachuring and the routes of the various parties are shown. Map (c) is of great value as it represents a detailed study of the glaciers debouching from the Antarctic ice cap on the western side of McMurdo Sound. It illustrates Griffith Taylor's contribution to the physiography of the region (Vol. II, pp. 124-198 and 285-294). The nomenclature of the map perpetuates the names of numerous modern investigators, e. g., Davis, Walcott, Hobbs, and Suess. Relief is in contours, blue on the glaciers, black elsewhere. Map (d) is a small sketch map of the same region indicating exposed rock surfaces and moving glaciers. Maps (d), (f) and (g) present various details in the vicinity of McMurdo Sound. Map (h) is a general map of the northern part of Victoria Land with insets of the vicinity of Cape Adare and of Terra Nova Bay. Maps (i) and (j) show the track of the *Terra Nova*, the former covering the region south of 60° S.]

Other Maps Received

NORTH AMERICA

United States-Canada. Stanford's Railway Map of the United States and Part of Canada, showing the principal railways quoted in the Stock Exchange daily official list. 1:5,274,720. Edw. Stanford, Ltd., London, 1913.

CANADA

Ontario. Wagon Road Map of Eastern Ontario. 6 mi. to 1 in. The Mission Book Co., Ltd., Toronto, 1900.

UNITED STATES

Western United States. Part of United States west of Mississippi River, prepared under direction of I. P. Berthrong, Chief of Drafting Division, G. L. O. [27 mi. to 1 in.] General Land Office, Washington, 1914. 15 cents.

XUM

AFRICA

Abyssinia. [Lago Tsana]. 1:600,000. Ministero delle Colonie, Direzione Central degli Affari Coloniali per l'Eritrea e la Somalia. [Roma], 1913.

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